Macintosh Computers
Vol. II

Service Guide

Modular Computers
March 1993

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This March 1993 update to volumes 1 and 2 of the *Apple Service Guide for Macintosh Computers* replaces the previous version of the guides. For this update we made the following additions and revisions:

- Volume 1 covers all compact and portable Macintosh® computers—that is, all Macintosh computers that do not require an external monitor.
- Volume 2 covers all modular Macintosh computers.
- The guides are slightly larger (8.5 inches by 5.5 inches) than the previous versions.
- This release contains documentation on 13 additional computers.

Organization

Volume 1 of the *Apple Service Guide for Macintosh Computers* contains service and repair information for the following computers:

- Macintosh 128K, 512K, 512K enhanced, and Plus
- Macintosh SE and SE/30
- Macintosh Classic®, Classic II, and Performa™ 200
- Macintosh Portable
- Macintosh PowerBook™ 100, 140, 145, 160, 170, and 180
- Macintosh PowerBook Duo™ 210, Duo 230, Duo Dock, and Duo MiniDock

Volume 2 of the *Apple Service Guide for Macintosh Computers* contains service and repair information for the following computers:

- Macintosh LC, LC II, and Performa 400
- Macintosh II, IIx, and IIfx
- Macintosh IIcx, IIci, and IIsi
- Macintosh IIvx, IIvi, and Performa 600
- Macintosh Quadra™ 700, 900, and 950

Each volume also contains a SIMM chart for the products covered by that volume and information on ADB devices, module symptom codes, diagnostics, ports, cables, and pinouts.

Using the Guide

Important **When ordering a replacement module or spare part, be sure to check the part number given in the guide against the current price pages in *Service Source*. Remember that the *Apple Service Guide* is not updated on a regular basis.**

▲ Warning Make sure that you are not grounded when you work on plugged-in equipment.

▲ Warning Electrostatic discharge (ESD) can cause severe damage to sensitive microcircuits. Macintosh circuit boards contain CMOS components, among the most sensitive chips in use today. CMOS chips, ROMs, and SIMMs are very susceptible to ESD and skin acid damage. To prevent damage to these components, handle them only by the edges.

▲ Warning A "dead" lithium battery is considered hazardous waste and has some potential for explosion if improperly handled. Mark the battery *DEAD,* place it in a zip-locked wrapper and the packaging used to ship the replacement battery. Return the dead battery to Apple, where it will be disposed of following EPA guidelines. Exception: If the battery is physically damaged, do not return it to Apple; dispose of the battery locally according to local ordinances.

Electrostatic discharge (ESD) can irreparably damage the sensitive CMOS chips and printed circuitry of modern electronic components. Plastic utensils, polystyrene products, polyester clothing, even the ungrounded touch of your hand carry sufficient electrostatic charges to damage electronic components. Follow the ESD prevention rules and set up an ESD-safe workstation as directed below.

ESD Prevention Rules

1. Before working on a device containing a printed circuit, ground yourself and your equipment. Use a grounded conductive workbench mat and a grounding wriststrap, and ground your equipment to the mat.

▲ **Warning** **Make sure that you are not grounded when you work on plugged-in equipment.**

2. Do not touch anybody who is working on integrated circuits. You could "zap" the equipment through the technician—even if the technician is grounded.
3. Use static-shielding bags for boards and chips during storage, transportation, and handling. Leave all Apple service exchange components in their ESD-safe packaging until you need them.
4. Handle all ICs by the body, not the leads. Also, do not touch the edge connectors or exposed circuitry on boards or cards.
5. Do not wear polyester clothing or bring plastic, vinyl, or polystyrene into the work environment. The electrostatic field around these nonconductors cannot be removed.
6. Never place components on any metal surface. Use antistatic, conductive, or foam rubber mats.
7. If possible, keep the humidity in the service area between 70% and 90%, and use an ion generator. Charge levels are reduced (but not eliminated) in high-humidity environments and in areas with ion generators.
8. If an ESD pad/workstation is not available, touch bare metal on the power supply to discharge electrostatic charges.

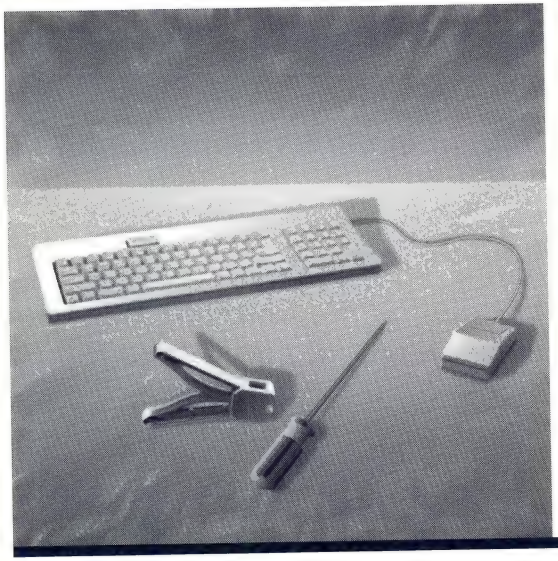
Setting Up an ESD-Safe Workstation

Materials Required

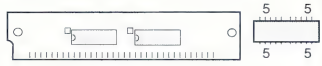
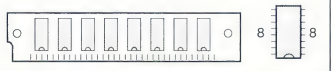
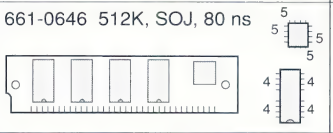
Conductive workbench mat with ground cord
Wriststrap with built-in 1-megohm resistor and ground cord
Equipment ground cord with alligator clips
Ground/polarity tester

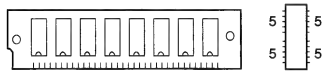
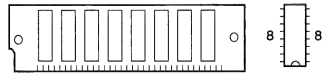
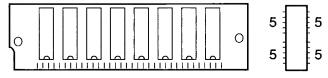
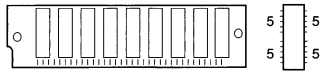
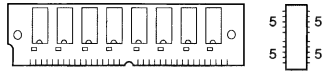
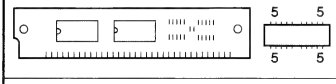
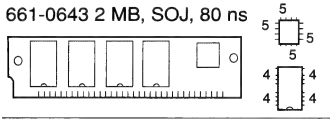
1. Remove all ESD hazards from the area. Nonconductive materials (for example, polyester, plastic, vinyl, and polystyrene) cannot be grounded and retain charges for hours and even days.
2. Use a ground/polarity tester to verify proper grounding of the power outlet. If the outlet is wired incorrectly, most testers show a light pattern that matches a code given on the tester. If the tester does not verify proper grounding, move to another outlet that is safe.
3. Connect the grounding cord of the workbench mat to ground.
4. Use a wriststrap grounding cord. Fasten it to the workbench mat and to the wriststrap. The wriststrap should touch your skin.
5. Finally, ground the equipment you are working on. Use alligator clips and a grounding cord to attach any metal part of the equipment to the grounded workbench mat.

General Information



SIMM Compatibility Chart

DRAM SIMMs for Service Exchange Modules	Macintosh Computers														
	LC	LC II	Performa 400	II	IIx	IIfx	IIsi	IIcx	IIci	IIvx	IIvi	Performa 600	Quadra 700	Quadra 900	Quadra 950
661-0402 256K, PLCC, 120 ns 				●	●			●							
661-0402 256K, DIP, 120 ns 				●	●			●							
661-0402 256K, SOJ, 120 ns 				●	●			●							
661-0402 256K, SOJ, 120 ns 				●	●			●							
661-0402 256K, SOJ, 120 ns 				●	●			●							
661-0494 256K, DIP, 120 ns 				●	●			●							
661-0519 256K, SOJ, 80 ns 				●	●		●	●	●	●	●	●			
661-0646 512K, SOJ, 80 ns 							●		●						
Slowest acceptable DRAM speed (ns)	100	100	100	120	120	80	100	120	80	80	80	80	80	80	80

DRAM SIMMs for Service Exchange Modules	Macintosh Computers														
	LC	LC II	Performa 400	II	IIx	IIfx	IIsi	IIcx	IIci	IIvx	IIvi	Performa 600	Quadra 700	Quadra 900	Quadra 950
661-0403 1 MB, SOJ, 120 ns 				●	●			●							
661-0410 1 MB, DIP, 120 ns 				●	●			●							
661-0520 1 MB, SOJ, 80 ns 	●	●	●	●	●		●	●	●	●	●	●	●	●	●
661-0546 1 MB, SOJ, 80 ns, Parity 	[1]	[1]	[1]	[1]	[1]		[1]	[1]	●				[1]	[1]	[1]
661-0548 1 MB, SOJ, 80 ns, 64-Pin 						●									
661-0719 1 MB, SOJ, 80 ns 	●	●	●				●	●	●				●	●	●
661-0643 2 MB, SOJ, 80 ns 	●	●	●				●		●	●	●	●			
Slowest acceptable DRAM speed (ns)	100	100	100	120	120	80	100	120	80	80	80	80	80	80	80

[1] The SIMM is compatible with the CPU, but the CPU does not use the parity feature of this SIMM.

Macintosh ADB Input Devices

This list includes all ADB input devices and their part numbers for all Macintosh computers except the Macintosh 128K, 512K, 512Ke, Plus, and Portable.

- Apple Keyboard 661-0383
- Apple Keyboard II 661-0603
- Apple Keyboard, French Canadian C661-0383
- Apple Keyboard, Spanish E661-0383
- Apple Keyboard and Apple Keyboard II parts
  - Bottom case, AK 815-1017
  - Bottom case, AK II, version A 815-6044
  - Bottom case, AK II, version B 815-6045
  - Cable, ADB keyboard, 1 meter 590-0361
  - Cable, ADB keyboard, 1 meter 590-0616
  - Key cap set, AK 658-7011
  - Keyboard encoder PCB, AK II, version A 981-0020
  - Keyboard encoder PCB, AK II, version B 981-0021
  - Keyboard cable, 2 meter 590-0152
  - Keystem, w/spring, AK II, version B (set of 10) 076-0422
  - Keyswitch, locking, tan/ivory, AK, AEK, AEK II 970-1263
  - Keyswitch set, ADB kybd, AK and AEK, tan (set of 10) 076-0209
  - Keyswitch set, ADB kybd, AEK II, ivory (set of 10) 076-0387
  - Rubber dome, AK II, version A (set of 10) 076-0423
  - Top case 810-6042
  - Top case, AK II, version A 810-6042
  - Top case, AK II, version B 810-6043
- Apple Extended Keyboard 661-0384
- Apple Extended Keyboard, French Canadian C661-0384
- Apple Extended Keyboard, German D661-0384
- Apple Extended Keyboard, Italian T661-0384
- Apple Extended Keyboard, Spanish E661-0384
- Apple Extended Keyboard parts
  - Bottom case 815-1019
  - Cable, ADB keyboard, 1 meter 590-0361
  - Keycap set, AEK and AEK II 658-7010
  - Keyswitch, locking, tan/ivory, AK, AEK, AEK II 970-1263
  - Keyswitch set, ADB kybd, AK and AEK, tan (set of 10) 076-0209
  - Keyswitch set, ADB kybd, AEK II, ivory (set of 10) 076-0387
  - Top case 815-1018
- Apple Extended Keyboard II 661-0543
- Apple Extended Keyboard II, ISO, French EF661-0544
- Apple Extended Keyboard II, ISO, French Canadian EC661-0544
- Apple Extended Keyboard II, ISO, German ED661-0544
- Apple Extended Keyboard II, ISO, Italian ET661-0544

Apple Extended Keyboard II, ISO, Spanish EE661-0544
Apple Extended Keyboard II parts
- Bottom case, AEK II 658-5211
- Cable, ADB keyboard, 1 meter 590-0361
- Foot, front, AEK II 865-0057
- Foot, rear, adjustable, AEK II 865-1139
- Foot pad, rear, AEK II 865-0067
- Keycap set, AEK and AEK II 658-7010
- Keycap reset, AEK II 658-9001
- Keyboard assembly, w/keycaps, version A, AK II 949-0357
- Keyboard assembly, w/keycaps, version B, AK II 949-0358
- Keyswitch, locking, AEK II 937-0051
- Keyswitch, locking, tan/ivory, AK, AEK, AEK II 970-1263
- Keyswitch set, AEK II, white (set of 10) 922-0005
- Rack, adjustable foot, AEK II 815-1138
- Spring, foot return, AEK II 870-0030
- Template, AEK II 001-0017
- Top case, AEK II 658-5210

Mouse, ADB (replaced by 661-0479) 661-0338
- Mouse ball (25.4 mm dia), gray, rubber-coated 699-8001
- Mouse ball (21.9 mm dia), black 699-8038
- Retainer, ADB mouse (for 25.4 mm gray mouse ball) 076-0231
- Retainer, ADB mouse (for 21.9 mm black mouse ball) 815-0816

Mouse, ADB 661-0479
- Retainer, screw-on, ADB mouse (for 25.4 mm gray mouse ball) .. 815-1136

Module Symptom Codes

When returning a defective module to Apple, always enter on the SRO form the symptom code that best describes the problem. Do this as follows:

1. Locate and note the three-digit symptom code from the Module Symptom Codes chart.

2. Select the appropriate modifier code from the list below. This is the fourth digit of the symptom code.

Code	Modifier
1	Continuous
2	Intermittent
3	Environmental/cannot duplicate symptom
4	Always fails after awhile
5	Depends on configuration
6	Fails only with application software
7	Noisy
8	Inoperable upon first use

3. Write the four-digit code on the SRO form.

For example: A Macintosh logic board crashes after being on for an hour or more. The symptom code is 153, "System bombs or crashes." The board fails after it has been in use for awhile, so the modifier code is 4. Place the modifier code after the symptom code, and enter the error code 1534 on the SRO form.

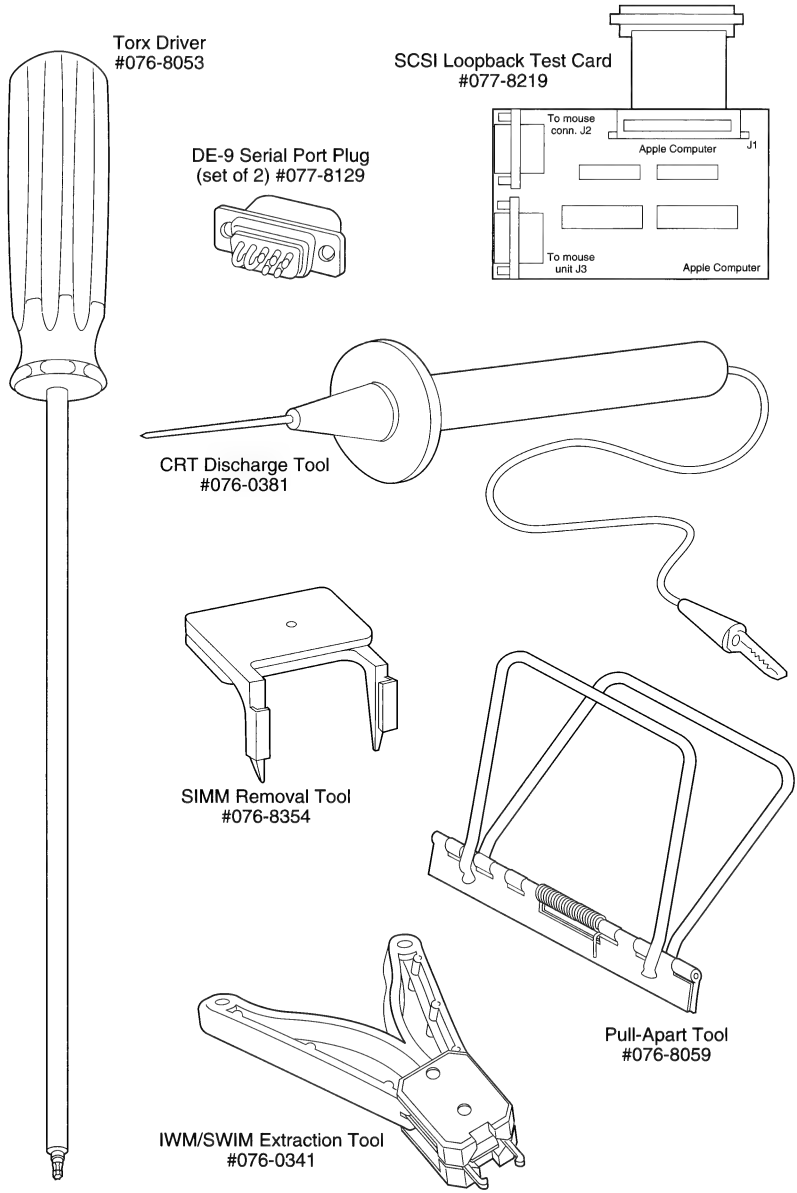
Module Symptom Codes

Code	Startup/Run Problems
150	Bad or no startup tone
151	Screen bright; no Mac face
152	Sad Mac/self-test fail/startup error
153	System bombs or crashes
154	No power light indicator with good power supply
155	Restarts or shuts down randomly
156	Can't shut down
Code	**Video/Sound Problems**
160	Bad or no color on display
161	Distorted or no video; system boots OK
162	Distorted or no sound; system boots OK

Code	I/O Device Problems
170	Bad or no response (keyboard, mouse, trackball...)
171	Good game paddle/joystick fails
172	Serial port failures
173	Printing or AppleTalk problem
174	Communications or modem port problems
175	Bad expansion slots (Apple II, Direct, NuBus...)
Code	**Drive I/O Errors**
180	Can't boot/read internal floppy drive
181	Can't boot/read external floppy drive
182	Can't write/format internal floppy drive
183	Can't write/format external floppy drive
184	Can't boot/read internal SCSI drive
185	Can't boot/read external SCSI drive
186	Can't write/format internal SCSI drive
187	Can't write/format external SCSI drive
Code	**Miscellaneous Problems**
190	Control Panel settings don't work
191	Connector or jack problems
192	SIMM socket problems
193	Board is cracked, damaged
194	Bad battery
Code	**CRT and Analog Boards**
250	Black screen
251	Vertical bright line
252	Horizontal bright line
253	Rolls vertically
254	Diagonal stripes
255	Dim or low intensity
256	Fuzzy screen, unclear characters
257	Unstable picture; logic board OK
258	Incorrect picture size or alignment
259	Lighted screen, no picture
260	Fan not spinning
261	Color not adjustable; no color
262	Distorted sound
263	No power, no raster

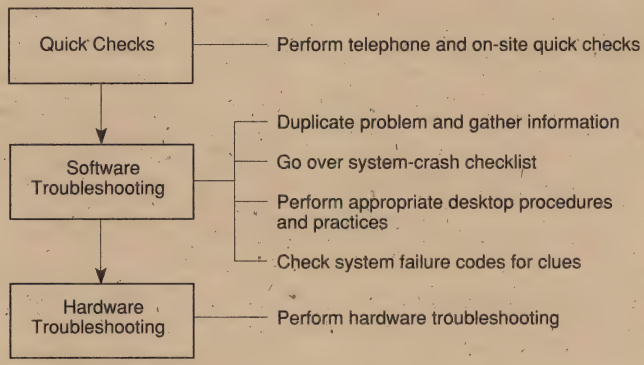
Code	Drive Problems
350	Won't eject
351	Won't format
352	Drive doesn't spin
353	Too many bad blocks
354	Won't mount
355	Won't recognize disk formatted on other drive
356	Won't read/write data; disk spins
357	Won't write data
358	Excessive read/write errors
359	Won't boot; reads/writes OK
360	Excessive seeking
361	Icon doesn't appear on desktop; formats OK
362	Won't format; able to see drive in SC setup
363	Won't format; unable to see drive in SC setup
364	Unable to access drive; system folder present
365	Noisy; works OK
Code	**Power Supply Problems**
450	Clicking noise
451	Fuses keep blowing
452	Causes system failure
453	Noisy; works OK
454	No power
455	System randomly resets
Code	**Keyboard, Mouse, Input Device Problems**
550	No or bad response
551	Bad keyswitch or button
552	Foreign substance spilled on unit
553	Sticky or bouncing keys
554	No cursor response
Code	**Printer Problems**
650	Improper print head movement
651	Paper won't feed
652	Self-test OK; won't print from host
653	Fails self-test
654	Won't select from front panel
655	Printer not seen in Chooser
656	Prints blank pages
657	Prints black pages
658	Print is distorted or uneven
659	Indicator light suggests fault
660	No power light

Special Tools Index



On-Site Troubleshooting

Overall Approach



Telephone and On-Site Quick Checks

- ✓ Check the power source and power connection.
- ✓ Check all cables and cable connections.
- ✓ Check the adjustment of all user controls.
- ✓ Check that not more than one system file is on the startup device/disk.
- ✓ Check that the computer system and the system software are compatible (see System-Software Configurations table in this section).
- ✓ Open the computer and verify that all circuit boards, fuses, and chips are secure, clean, and undamaged.

Information Gathering

When quick checks do not identify the problem, try duplicating the problem, and gather as much information about the problem as possible. Take special note of the following:

- Operating condition of the system when the problem occurs (application and version, Finder™ or MultiFinder®, system software and version, whether networked, system configuration, peripherals, INITs, CDEVs, DAs, etc.)
- Exactly what your customer is doing when the problem occurs
- What happens to the system (freezes, crashes, displays error message)
- What your customer has tried to do to fix the problem, and the outcome
- If the problem appeared recently, note what your customer recently changed or added to the system

Using this information, perform appropriate solutions from the following System-Crash Checklist. If this systematic approach does not fix the problem, your customer probably has a hardware problem (refer to "Hardware Troubleshooting" later in this section).

System-Crash Checklist

✓ **Check whether the problem is peculiar to one application (try replicating the problem using another application). If the application is at fault, consult the following chart for suggestions.**

Problem	Solutions
Program incompatible with MultiFinder (System 6 only)	1. Try booting offending program first. 2. Switch to Finder. 3. Run program from original disks.
Program incompatible with system software	1. Revert to older version of system software. 2. Remove program from system. 3. Contact vendor about program update.
Program corrupted	1. System crashes can corrupt program and system software. Remove program. 2. Reinstall program and system software from original disks. 3. Reinstall system software.
Insufficient memory to run program	1. If under MultiFinder or System 7, close other applications and restart program. (You may have to restart system.) 2. If under MultiFinder, switch to Finder (System 6 only). 3. Allocate more memory to application. Select application, select **Get Info** from menu bar, and increase allocated memory in dialog box. (MultiFinder or System 7 only) 4. If applicable, check RAM cache. If cache is set too high, computer diverts some RAM for system use, thus reducing RAM available for programs. 5. Install additional RAM.
Message "Application is busy or missing" displays	1. Make sure application is present on drive. 2. Make sure document was created with same version of application as application on drive. 3. Launch application first; then open document from application. 4. Rebuild desktop. 5. Reinstall application. 6. Run a utility program, such as Norton Utilities, that resets corrupted bundle bits.
Programs (especially DAs, INITs, and CDEVs) conflict	1. Run Compatibility Checker before installing System 7. Remove or update any questionable INITs or CDEVs (System 7 only). 2. If program was added just prior to problem, remove offending program. 3. Remove all DAs, INITs, and CDEVs, and replace one at a time until offender is found.

✓ **Check whether the problem is with system software (boot from a floppy) or with multiple system folders (use Find File).**

Problem	Solution
Multiple system folders	– Remove all system folders except folder with Macintosh icon on it (see Desktop Procedures and Practices).
Corrupted system software	– Replace system software. (When replacing corrupted system software, avoid introducing new problems. Always use Installer **on original system software disks**; do not use System 6 Installer with System 7. If you remove System file before running Installer, you must replace fonts and desk accessories. Make copies of your customer's fonts and desk accessories before running Installer. For more information, refer to Replacing the System File under Desktop Procedures and Practices.

Desktop Procedures and Practices

Identifying and remedying problems that may be software related requires familiarity with basic desktop management procedures and practices. An inappropriately managed desktop could cause the following problems.

Multiple System Folder Problems

Symptoms: System crashes; unusual error messages; font and DA lists change unexpectedly.
Occurs: When disks containing system folders are dragged onto system or system software is loaded without using Installer.
Remedy: Locate and remove all system folders without the Macintosh icon on the folder; also remove any extra System or Finder files.
Procedure: Boot from known-good system disk, use Find File to locate and remove multiple system folders, and reboot computer.

INIT and CDEV Conflicts

This problem is very common under System 7. Be sure to run the Compatibility Checker before installing System 7. Remove any questionable INITs or CDEVs (or update them with newer versions and rerun the Compatibility Checker).

Symptoms: System crashes and myriad of other problems.
Occurs: When INIT or CDEV conflicts with an application on system.
Remedy: Locate and remove all INITs and CDEVs, and then replace them one at a time until the conflict returns.
Procedure: Place all INITs and CDEVs in a separate folder within System Folder (this prevents INITs and CDEVs from loading when you boot system), and return each INIT and CDEV to System Folder one at a time. (Renaming an INIT, such as adding a prefix of "Z" so it loads last, may remedy the conflict.)

RAM Cache Out-of-Memory Problems

RAM cache is a feature that speeds up operation of the system. The RAM cache acts as a special RAM buffer between applications and drives. From 32K to 768K of the most frequently used blocks of data can be stored in the RAM cache, which can significantly increase speed within an application and cause applications to launch from and return to the Finder more quickly. Memory problems can occur when the RAM cache is set too high.

Symptoms: Insufficient memory problems; applications won't run; degraded system performance; ID=28 system bombs in systems configured with 1 MB or less of memory.

Occurs: When RAM cache is set too high (available system memory is insufficient to run program).

Remedy: Switch off RAM cache, or reduce amount of memory allocated to RAM cache.

Procedure: Open Control Panel (System 6) or Memory Control Panel (System 7) and reduce RAM cache allocation as desired. Reboot system.

Rebuilding the Desktop / Slow Finder

Symptoms: Finder cannot locate applications that are on disk drive, or Finder is slow.

Occurs: When disk is overloaded with applications and icons, or applications contain excessive number of file comments.

Remedy: Rebuild desktop file (which erases comments from Get Info comment box of all applications on drive).

Procedure: Hold down <Option> and <Command> keys while booting, or while quitting application if operating in Finder. Click **Yes** in resulting dialog box to rebuild the desktop.

Resetting Corrupted Parameter RAM

Symptoms: Macintosh II does not boot from internal hard drive.

Occurs: When an application crashes, it sometimes executes code that corrupts parameter RAM (PRAM) on Macintosh II systems running system software prior to release 5.0. PRAM contains information required by the Macintosh operating system (OS) to start up from an internal SCSI drive, as well as other OS information.

Remedy: Reset PRAM to its default value.

Procedure: System 6: Hold down <Shift>, <Option>, and <Command> keys while opening Control Panel. Click **Yes** in resulting dialog box to clear PRAM, which resets some user options to their default values.

System 7: Hold down <Option>, <Command>, <P>, and <R> during startup but before "Welcome to Macintosh" appears. (If using a Macintosh II family computer with a color monitor, the monitor will default to monochrome; reset the color controls.)

Restoring Damaged Boot Blocks

Symptoms: System does not recognize or boot from hard drive.

Occurs: When startup instructions (boot blocks) on the hard drive are damaged or the hard disk driver is damaged.

Remedy: Replace the hard disk driver.

Procedure: Boot the computer from a startup disk that contains an appropriate hard disk setup program. (For Apple hard drives, use the *Apple HDSC Setup* program found on a *Macintosh System Utilities* disk.) Install or update the hard disk driver on the hard drive.

Removing and Preventing Viruses

Symptoms: Unexplained system crashes; corrupted or disappearing files.

Occurs: After using a disk or program that is infected by a virus (often contracted from shareware found on electronic bulletin boards).

Remedy: Use an antivirus program to eradicate the virus, and practice virus prevention in the future.

Procedure: Boot the computer from a startup disk that contains an antivirus application and launch the eradication program. There are several effective antivirus programs, including *Disinfectant* by John Norstad, *Interferon* and *Virex* by Robert Woodhead, and *SAM* from Symantec.

Prevention: Many of the antivirus applications include programs for screening inserted disks for known viruses—use them! Also, master disks should be locked; applications can be protected by locking them using the Get Info box. If running System 7, be sure the virus utility is System 7 compatible. Incompatible versions can cause unexpected problems that are difficult to track down.

Replacing the System File (System 6 only)

Symptoms: Minor, intermittent problems accessing disks, printing, starting system, or launching programs.

Occurs: When System file or related files are damaged, often from disk writing errors.

Remedy: Replace the System file using the Installer. To ensure that the problem is corrected, you should remove the entire System Folder before using the Installer.

Procedure: Copy all non-Apple System Folder files from the System Folder to another folder on the desktop (see list of Apple System Folder files below). Then drag the System Folder into the Trash and start up the Installer program from the original system software disk. Place the non-Apple files in the new System Folder. (For information about using the Installer, refer to "Replacing/Installing System Software" later in this section.)

Apple Files (System 6):

Access Privileges	Key Layout	MultiFinder	Finder
Backgrounder	AppleShare	Keyboard	Mouse
Clipboard File	DA Handler	Responder	Color
Startup Device	Easy Access	Monitors	System
Scrapbook File	Finder Startup	General	Sound

You are experiencing a serious system failure if your screen fills with dots, strange patterns, or garbage characters, or your computer emits sounds similar to muted gunfire. Other system failures, often called crashes, can result in a hung system (for instance, your cursor is frozen in place on the screen) or a system bomb with an error message and ID number. Often your only alternative is to press the reset button on the programmer's switch or restart the computer. However, if you encounter an alert box containing an error message and code, check the error code against one of the tables on the following pages.

You can encounter three types of Macintosh system error codes: boot (Sad Mac®) error codes, system error codes, and negative value error codes. Explanations of these error codes can be found in the following tables. When possible, these explanations include suggestions that may help isolate the problem. Additional suggestions are given below on this page. If these suggestions and the software troubleshooting recommendations on the previous pages of this section do not help, you probably have a hardware problem. Refer to "Startup Problems—Flowcharts" later in this section.

Introduction

Sad Mac, system, and application error codes can help lead you to the source of the problem. If the error code tables do not recommend a solution, or the solution does not fix the problem, keep in mind that serious system failures can be caused by:

- Software problems (damaged program or system files, incompatible INIT files)
- Data problems (damaged or incomplete data files, corrupted PRAM)
- Damaged boot blocks
- Hardware problems

To rectify system problems, try rebuilding the desktop and restarting your system. If this procedure does not rectify the problem, use another startup disk and try:

1. Removing INITs from your system (especially INITs added recently)
2. Checking the disk for a virus
3. Replacing the System file and Finder using Installer
4. Replacing the application with a fresh copy from the master disk
5. Resetting PRAM
6. Restoring the boot blocks

For instructions on performing these procedures, refer to Desktop Procedures and Practices earlier in this section.

Sad Mac Error Codes

If a Macintosh Plus fails at startup, you will see a Sad Mac icon and a six-digit error code. If a Macintosh SE fails at startup, the problem is usually bad RAM and you will see a 16-digit SIMM error code (see the Macintosh SE chapter in Volume 1). If other Macintosh computers fail at startup, you will hear a series of error chords (see Flowchart 2, Startup and Error Chords).

Sad Mac error codes can mean that the computer has failed the internal diagnostic tests and you have a hardware problem. Sad Mac codes can also have less serious causes such as:

- A non-system disk in the default drive
- A bad boot disk
- An incompatible system file on the boot disk
- No Finder on the boot disk
- A stuck programmer's switch

Sad Mac Icon

Sad Mac Error Codes

Code	Meaning	Code	Meaning
01_ _ _ _	ROM test failure	0F0006	Overflow trap - TRAPV instruction[2]
02_ _ _ _	RAM test failure (bus subtest)[1]	0F0007	Privilege violation[2]
03_ _ _ _	RAM test failure (byte write)[1]	0F0008	Trace trap[2]
04_ _ _ _	RAM test failure (mod3 test)[1]	0F0009	Trap dispatcher error[2]
05_ _ _ _	RAM failure (address uniqueness)[1]	0F000A	Line 1111 trap[2]
0F0001	Bus error[2]	0F000B	Other trap[2]
0F0002	Address error[2]	0F000C	Unimplemented trap executed[2]
0F0003	Illegal instruction[2]	0F000D	Interrupt button, programmer's switch[2,3]
0F0004	Zero divide[2]	0F0064	Bad System file[2,4]
0F0005	Check trap - CHK instruction[2]	0F0065	Bad Finder[2]

1 The first two digits indicate a RAM failure; the last four digits identify (in hexadecimal) the suspected bad chip. Try removing the SIMMs, rubbing the connection area with an eraser to improve the connection, and replacing the SIMMs. If this procedure doesn't help, isolate the bad SIMM (refer to Flowchart 3, SIMM Verification).
2 "0F" indicates a software error—the startup device was spinning before the failure occurred. Try: (1) Restarting the computer with the <Option> and <Command> keys held down (rebuilding the desktop) or (2) Replacing the System file.
3 Check the interrupt button—it could be stuck.
4 The System file may be missing from the startup drive.

System Error Codes

The two-digit system error code is located in the lower-right corner of the dialog box that informs you "A serious system error has occurred." Refer to the following two tables for a list of these codes and an explanation of their meaning.

System Error Codes

Code	Type	Meaning
01	Bus error	Program attempts to access an invalid memory location. Error is often caused by corrupt application. Replace application with known-good copy or upgraded version. If replacing software does not help, the problem is probably hardware related.
02	Address error	A corrupt application has placed program information in an odd vs. even address location. Install a known-good copy or upgraded version of the application.
03	Illegal instruction	Processor receives an instruction that does not match its internal list of instructions.
04	Zero divide	Programmer told processor to divide by 0 (mathematically impossible).
05	Range check error	Index is out of range (for example, programmer declares an array of five elements and searches for the sixth).
06	Overflow	Computer attempts to store a number that is too large for the allotted space.
07	Privilege violation	68000 is running in "user" mode and attempts to execute a command that requires "supervisor" mode.
08	Trace mode error	68000 chip can trace itself for debugging; can interfere with normal execution.
09	Line 1010 trap	Processor cannot execute a ROM call accessed via a trap with a hexadecimal "A" code. Often caused by a corrupt application. Replace application with a known-good copy or upgraded version.
10	Line 1111 trap	An incorrect ROM call.
11	Exception error	A miscellaneous hardware error not covered elsewhere.
12	Unimplemented core routine	Occurs when program attempts to execute a ROM call via an undefined trap.
13	Uninstalled interrupt	Needed routines are not available or the interrupt switch is pressed when a runtime debugger is not present.
14	I/O core error	Error in the file system or the device manager system.
15	Segment loader error	System could not load needed segment from disk into RAM memory. Often caused by a corrupt application. Replace application with a known-good copy or upgraded version.
16	Floating point error	A mathematical error.

Code	Type	Meaning
17-24	Packages not present (0-7)	System tries/fails to read special sections of the System file called "packages." System file may be damaged.
25	Memory full	Program requests a chunk of memory, but the system couldn't find enough.
26	Bad program launch	Attempt to load program without a CODE resource of 0; program is not a real program. Often caused by a corrupt application. Replace application with a known-good copy or upgraded version.
27	File system map damaged	Something is wrong with information on the disk. Try rebuilding the desktop.
28	Stack ran into heap	Two competing areas, the stack and heap, have collided. You're out of memory or memory is not being managed properly.
30	Disk insertion error	
31	No disk insertion	
33	negZcbFreeErr	ZcbFree has gone negative.
41	Finder error	Attempt to boot with startup disk that does not contain Finder. Create a new startup disk.
51	Bad slot interrupt	Unserviceable slot interrupt.
81	Bad SANE opcode	Bad opcode given to SANE Pack 4.
84	Menu purge error	Happens when a menu is purged.
85	MBarNFnd	System error—cannot find MBDF.
86	HMenu Find error	System error—recursively defined HMenus.
87	WDEFnFND	Could not load WDEF.
88	CDEFnFND	Could not load CDEF.
89	MDEFnFND	Could not load MDEF.
98	No patch	Can't patch for particular model Macintosh.
99	Bad patch	Can't load patch resource.
101	Parity error	Memory parity error.
102	Old System	System is too old for this ROM.
103	32-bit mode	Booting in 32-bit mode on a 24-bit system.
20000	Shut down or restart	User can choose ShutDown or Restart.
20001	Switch off or restart	User can choose to switch off or Restart.
20002	Forced quit	Allows user to exit to Shell.
32767	System error	General system error.

Negative Value Error Codes

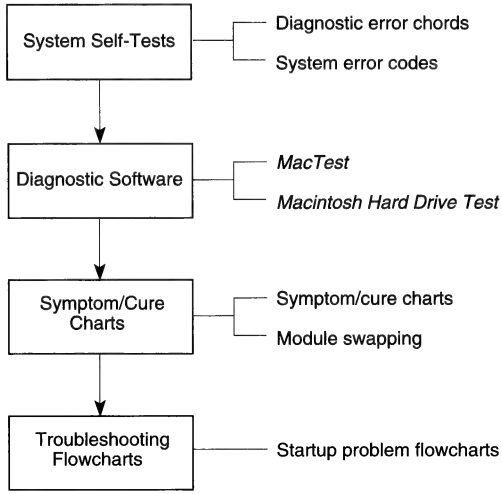
Rather than receive an error message such as "The disk is locked," you may receive a negative value error code such as -44. Refer to the Negative Value Error Codes table below for these codes and their general meanings. If you need more specific information, refer to the Technical Info library on AppleLink®.

Negative Value Error Codes

Code	Error Type
0 to -8	General system errors
-9 to -21	Color manager errors
-17 to -30	I/O system errors
-33 to -61	File system errors
-64 to -66	Font manager errors
-64 to -90	Disk, serial ports, clock specific errors
-91 to -99	AppleTalk errors
-100 to -102	Scrap manager errors
-108 to -117	Storage allocator errors
-120 to -127	HFS errors
-126 to -128	Menu manager errors
-130 to -132	HFS file ID errors
-147 to -158	Color QuickDraw and color manager errors
-185 to -199	Resource manager errors (other than I/O)
-200 to -232	Sound manager errors
-250 to -261	MIDI manager errors
-299	Notification manager error
-290 to -351	Start manager errors
-360 & -400	Device manager slot support errors
-450 to -463	Edition manager errors
-470 to 489	SCSI manager errors

Code	Error Type
-500	QuickDraw error
-501	Text edit error
-502	O/S error
-600 to -610	Process errors
-620 to -625	Memory dispatch errors
-800 to -813	Database access (Pack 13) errors
-850 to -863	Help manager errors
-900 to -932	AppleTalk — PPC toolbox errors
-1024 to 1029	AppleTalk — NBP errors
-1066 to -1075	ASP errors (XPP driver)
-1096 to -1105	AppleTalk — ATP errors
-1273 to -1280	Data stream protocol — DSP driver errors
-1300 to -1305	HFS errors
-1700 to -1719	AppleEvent errors
-3101 to -3109	AppleTalk — ATP errors
-4096 to -4101	Print Manager w/LaserWriter errors
-5000 to -5021	File manager extensions errors
-5000 to -5032	AFP errors (XPP driver)
-5500 to -5502	SysEnvirons errors
-5550 to -5553	Gestalt errors
-8132 to -8160	LaserWriter driver errors
-11000 to -10005	PictInfo errors
-13000 to -13005	Power manager errors
-23000 to -23048	Mac TCP errors
-32640 & -32768	Primary or secondary INIT code errors

Isolating a Hardware Problem



- System Self-Tests—Start up the customer's system, listen for diagnostic error chords (see Flowchart 2, Startup and Error Chords in this section), and look for system error codes (refer to "System Failure Codes" in this section).

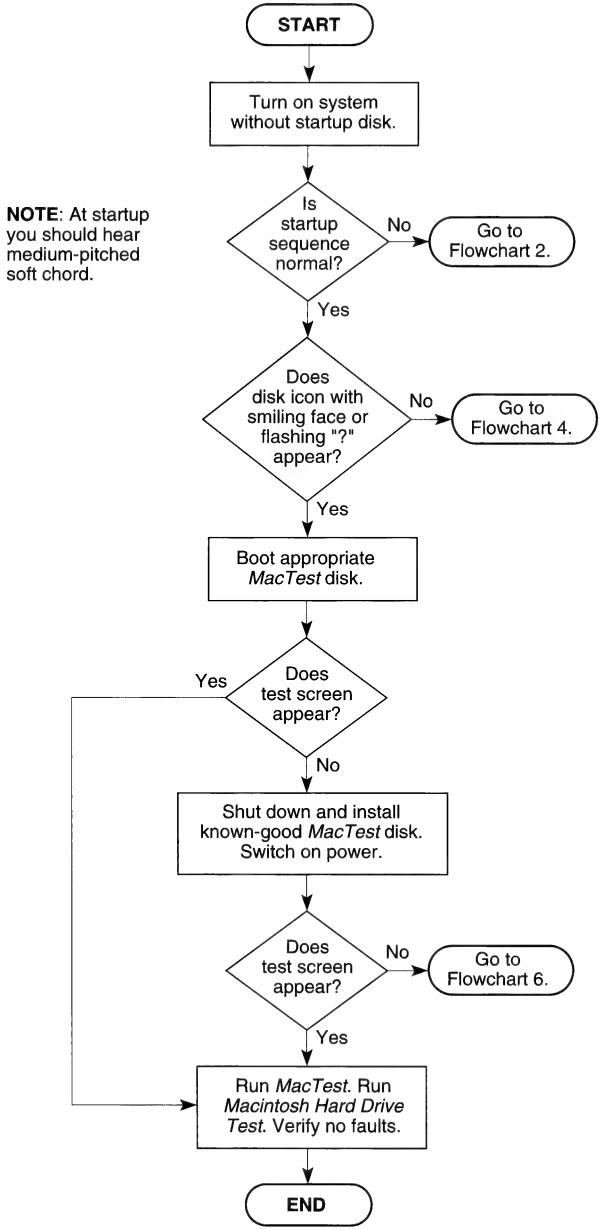
- Diagnostic Software—If the system passes the self-tests but the problem persists, try running the appropriate *MacTest*™ program (refer to "MacTest" later in this section for *MacTest* versions and procedures). If you suspect a hard drive problem, you should also run the *Macintosh Hard Drive Test* program.

- Symptom Charts/Module Swapping—If the customer's system (or *MacTest*) does not boot or *MacTest* fails to find the problem, refer to the symptom/cure charts in the section that covers your customer's computer. If you think you recognize the problem and you have the necessary replacement module with you, try module swapping.

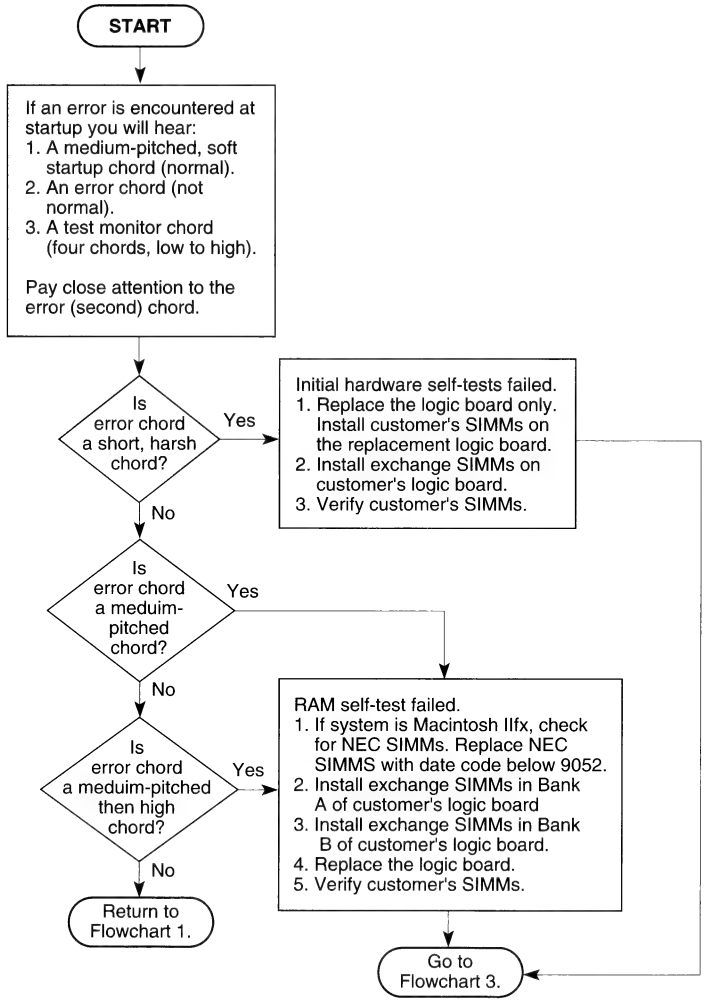
- Troubleshooting Flowcharts—If the customer's system (or *MacTest*) does not boot or *MacTest* fails to find the problem and the problem is not clearly defined or not listed in the symptom/cure charts, refer to "Startup Problems—Flowcharts" at the end of this section. These flowcharts present a step-by-step procedure for isolating the problem.

Hardware Troubleshooting Guidelines

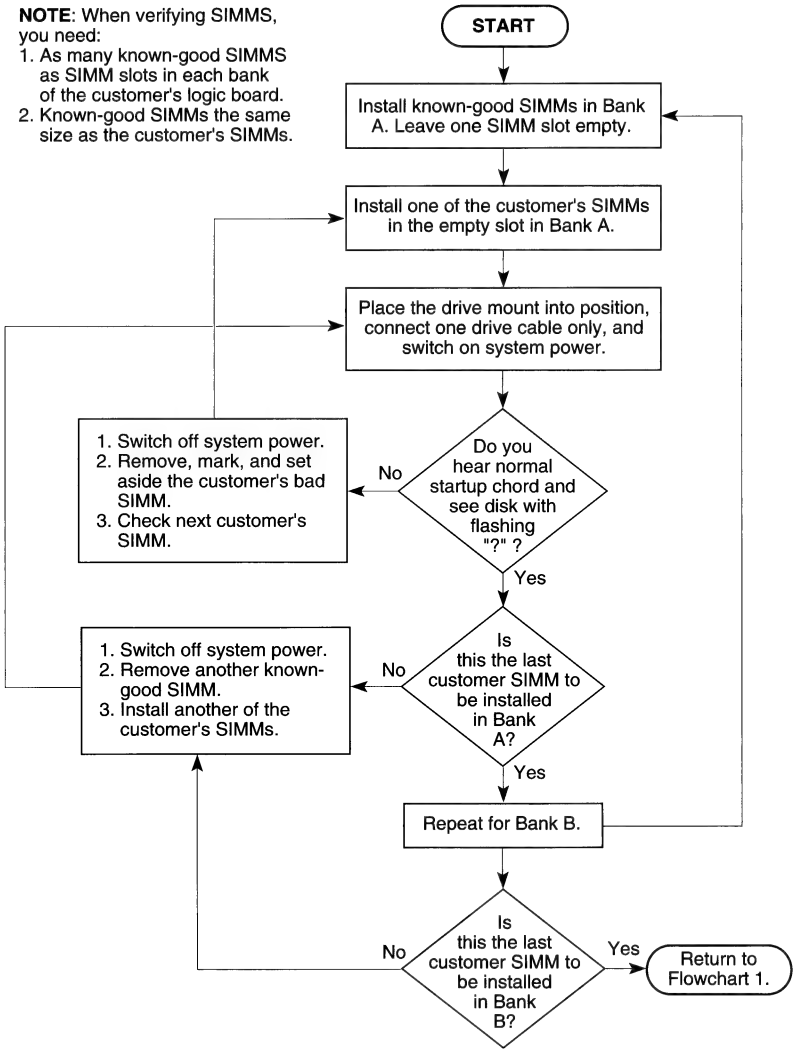
1. Use only known-good test equipment and diagnostic programs.
2. The troubleshooting tools are designed to test a system in its minimum configuration. Disconnect external peripherals and remove all NuBus™ cards. After verifying that the computer is fully operational, reinstall or reconnect and test each expansion card and external device one at a time.
3. When using the symptom/cure charts, always try the solutions one at a time, in sequence, until you fix the problem. If the problem remains, reinstall the original module before trying the next solution.
4. The hardware troubleshooting flowcharts verify each repair action by looping back to the start (Flowchart 1). If a repair does not fix the problem, reinstall the original module, return to the flowblock of origin, and perform the next repair action on the list.
5. When instructed to replace the logic board only, place the customer's SIMMs on the replacement logic board. Be sure to use the SIMM removal tool (see "Special Tools Index" under General Information). To test the customer's SIMMs, refer to Flowchart 3, SIMM Verification, in this section.
6. Always verify that the original problem has been fixed. To verify that the original problem is fixed, duplicate the conditions under which it appeared. To verify that there are no additional faults, run *MacTest.*



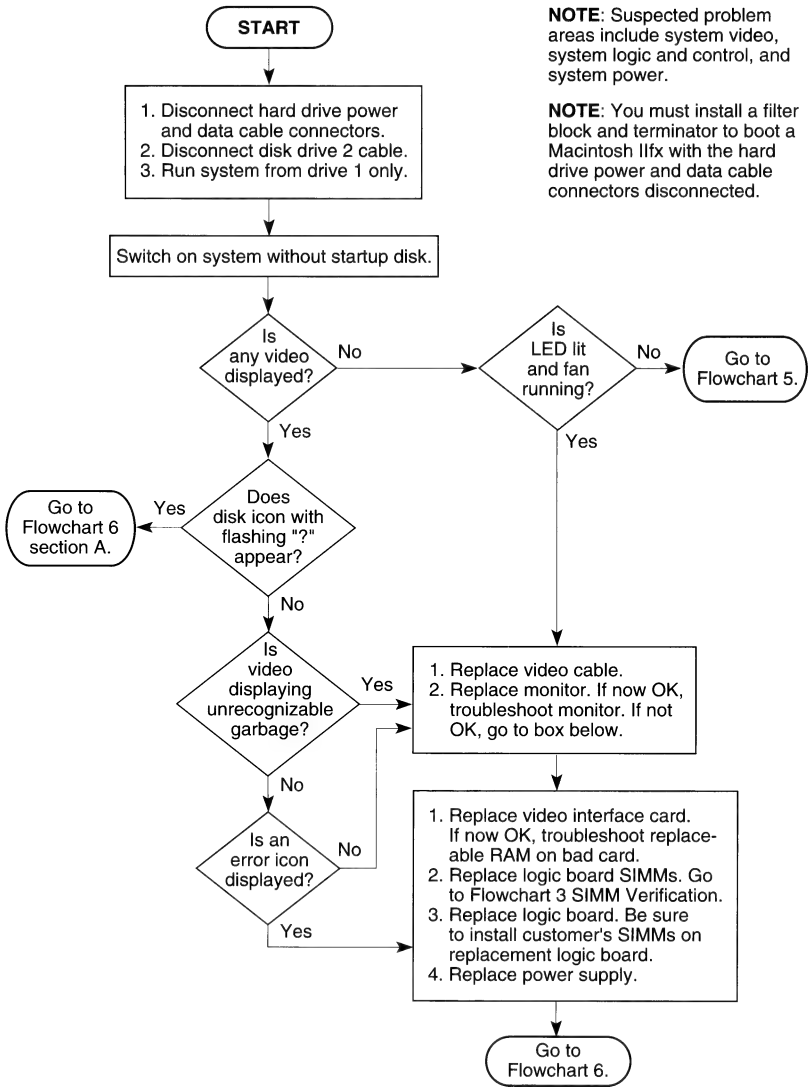
Flowchart 1 Startup Problems



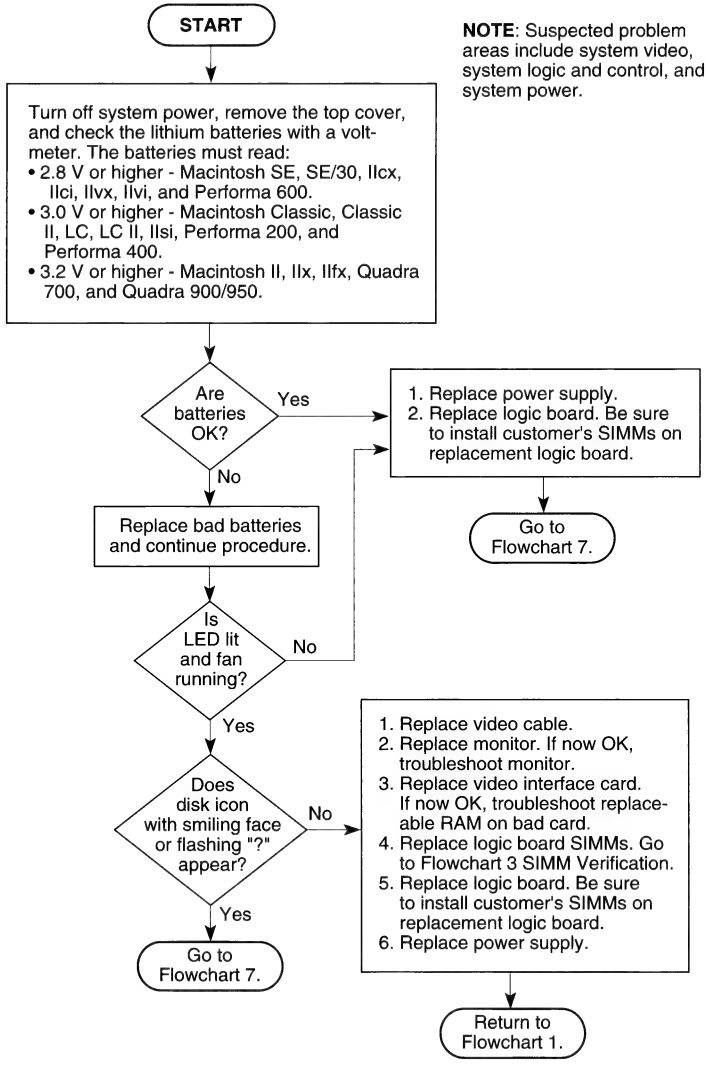
Flowchart 2 Startup and Error Chords



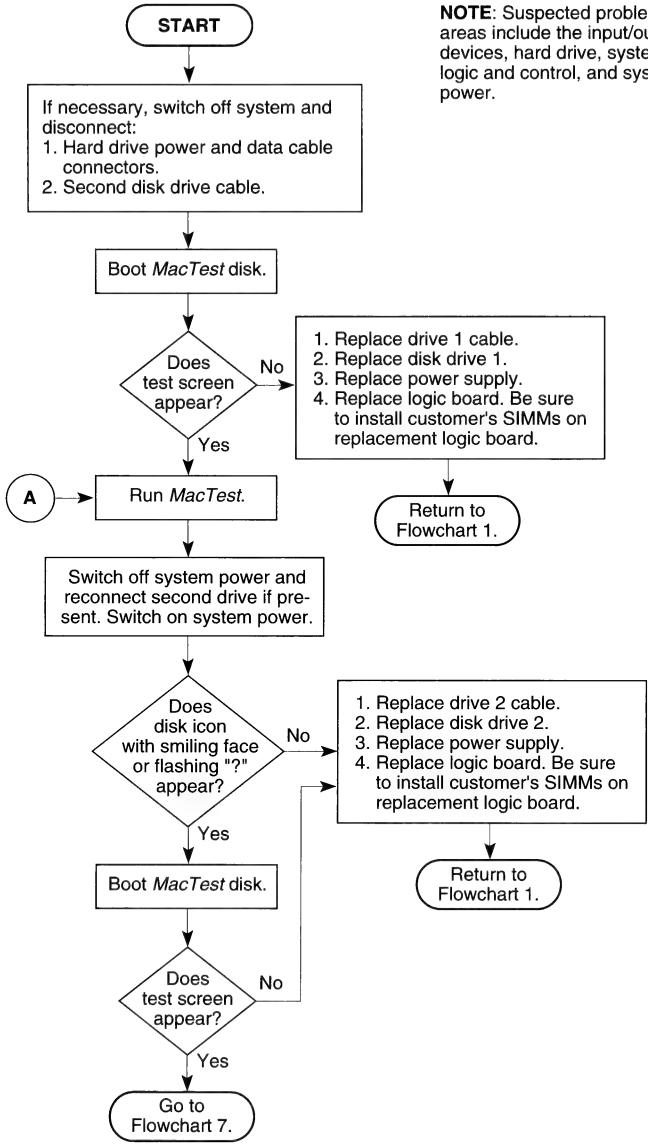
Flowchart 3 SIMM Verification



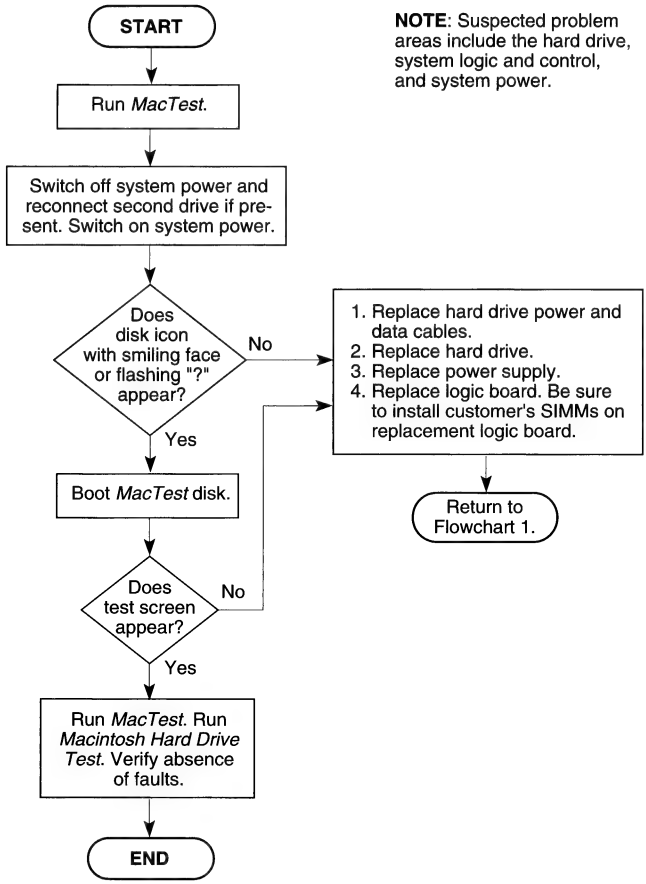
Flowchart 4 Startup Problems



Flowchart 5 Startup Problems



Flowchart 6 Startup Problems



Flowchart 7 Startup Problems

You may need to install system software at the customer's site. Replacing hard drives on systems that shipped with the operating system already installed requires reinstalling system software.

Installing System Software Versions 6.0.2 to 6.0.4

You'll need System Software, version 6.0.2, 6.0.3, or 6.0.4 (System & Printing Tools, Utilities 1 & 2).

1. Insert the *System Tools* disk in a floppy drive, and switch on the computer.
2. Double-click on the *System Tools* disk icon, the Setup Folder, and Installer.
3. Select the drive on which you want to install system software. Click **Drive** until you see the desired drive.
4. Select your computer type and click **Install.**
5. When finished, quit the Installer and reboot.

Installing System Software Versions 6.0.5 to 6.08

The Installer has Easy Install and Customize options. Easy Install automatically installs system and printer software that is appropriate for the destination drive and your computer. You must use the Customize option to install AppleShare® workstation software. You can also use the Customize option to create a boot disk with the minimal software required for any Macintosh system.

You'll need System Software, version 6.0.5, 6.0.6, 6.0.7, or 6.0.8 (System & Printing Tools, Utilities 1 & 2, and HyperCard®).

1. Insert the *System Tools* disk in a floppy drive and switch on the computer.
2. Double-click on the *System Tools* disk icon and on the Installer.
3. When the welcome screen appears, click **OK**.
4. Select the drive on which you want to install system software. Click **Switch Disk** until you see this drive.
5. Easy Install: Click **Install.** The appropriate software is automatically installed.

   Customize: Click **Customize**. Then select (click or shift-click) the software you wish to install from the options listed in the scrollable window. Click **Install**. The selected software is then installed.
6. When finished, quit the Installer and reboot.

Installing System Software Version 7 or Later

Note It's a good idea to make a backup copy of your hard drive before you install System 7.

1. Insert *Before You Install System 7* into a floppy drive.
2. Click on the Compatibility Checker option. If you see a button labeled Set Up, click the Set Up button, then choose which disks you want to check.
3. Click **Start Checking**. The Compatibility Checker scans your system and displays messages that report the progress of the scan.
4. If the Compatibility Checker finds incompatible or unknown items in the System Folder of your startup disk, you'll see the message "Attention: Potential problems with System Folder items." To move these items out of your System Folder, click **Move Items**.
5. When the Compatibility Checker finishes examining your system, you'll see the results displayed on the screen. The table below lists what you should do about each type of item on the report.

Item	What to Do
Incompatible or unknown items in the System Folder	Remove these items from the System Folder before installing System 7. (If you used the Move Items button, these items have already been moved to the May Not Work With System 7 folder.)
Other incompatible or unknown programs	You can install System 7—however, you should upgrade to a compatible version of these programs before using them with System 7.
Mostly compatible programs	No action is necessary. (If you like, you can obtain a more recent version.)
Compatible programs	No action is necessary.

6. Insert the *Install 1* disk into a floppy drive, and switch on the computer. The Installer welcome screen appears.
7. Click **OK** to clear the welcome screen. The dialog box that appears provides two options—Easy Install and Customize. Easy Install is suitable for most Macintosh users.
8. Select the drive on which you want to install system software. Click **Drive** until you see the desired drive.
9. Click **Install.**
10. Follow the on-screen instructions, and insert other floppy disks as requested.
11. When you see a message reporting that the installation was successful, click **Quit.**

System-Software Configurations

Macintosh Computer	Recommended System and Finder Versions	Acceptable System and Finder Versions
LC, IIsi	System 6.0.7/Finder 6.1 System 6.0.8/Finder 6.1	System 7*
LC II	System/Finder 7.0.1	System 7*
Performa 400, 600	System 7.0.1P	System/Finder 7.0.1
II	System 3.2/Finder 5.3 System 3.3/Finder 5.4 System 3.4/Finder 5.4 System 6.0.5/Finder 6.1 System 6.0.7/Finder 6.1 System 6.0.8/Finder 6.1	System 4.1/Finder 5.5 System 4.2/Finder 6.0 System 7*
IIx, IIcx	System 6.0.3/Finder 6.1 System 6.0.4/Finder 6.1 System 6.0.5/Finder 6.1 System 6.0.7/Finder 6.1 System 6.0.8/Finder 6.1	System 7*
IIci	System 6.0.4/Finder 6.1 System 6.0.5/Finder 6.1 System 6.0.7/Finder 6.1 System 6.0.8/Finder 6.1	System 7*
IIfx	System 6.0.5/Finder 6.1 System 6.0.7/Finder 6.1 System 6.0.8/Finder 6.1	System 7*
IIvx, IIvi	System/Finder 7.0.1	System 7*
Quadra 700, 900, 950	System 6.0.3/Finder 6.1 System 6.0.4/Finder 6.1 System 6.0.5/Finder 6.1 System 6.0.7/Finder 6.1 System 6.0.8/Finder 6.1	System 7*

* These computers will run System 7 if they have sufficient memory.

When used as stand-alone tests, the *MacTest* diagnostic programs perform pass/fail functional tests of the Macintosh computer systems. The procedures for using all *MacTest* programs are similar, but not identical. Be sure to use the *MacTest* program for the system you want to test. The following table lists the *MacTest* program you need to test Apple products.

MacTest Diagnostics

Diagnostic	Products Tested
MacTest Pro	Macintosh SE/30 Macintosh Classic II Macintosh PowerBook 100, 140, 145, 160, 170, 180 Macintosh PowerBook Duo 210, 230 Macintosh Performa 200, 400, 600 Macintosh LC, LC II Macintosh II, IIx, IIfx Macintosh IIcx Macintosh IIvx, IIvi Macintosh Quadra 700, 900, 950 Macintosh NuBus video cards Macintosh monitors and displays Macintosh drives and storage devices Macintosh modems Apple IIe Card
MacTest CL	Macintosh Classic
MacTest Portable	Macintosh Portable
MacTest MP	Macintosh IIsi Macintosh IIci Cache Card
MacTest IIcx/IIci	Macintosh IIci PC 5.25 Drive Card
MacTest v. 7.0	Macintosh 128K, 512K, Plus
MacTest SE v3.0	Macintosh SE

Be sure to read the Read Me file that accompanies the *MacTest Pro* diagnostic. This file has the latest information about and operating tips for running the diagnostic.

Things to Remember

- Use *Apple DiskCopy* 4.2 to make a backup copy of the *MacTest* disks. Do not write-protect your working disk.
- Some *MacTest Pro* bootable disks contain special System Enabler files for use on Macintosh IIvi, IIvx, Performa, and Macintosh PowerBook 160/180 systems. Do not remove these files from the bootable disks.

- If you cannot boot the *MacTest* disk:
  a. Check the power cable and internal cable connections.
  b. Refer to the appropriate symptom/cure chart, and replace the module(s) specified for your problem.
- (**Macintosh Portable only**) The power adapter must be connected to the Macintosh Portable for the *AppleCat®/MacTest* diagnostic to operate.
- The application memory partition of *MacTest Pro* is set to 800K, but 1024K is the preferred setting. If the computer under test has more than 2 MB of RAM, Apple suggests you set the application memory partition to 1024K. (Click once on the the *MacTest Pro* application icon to highlight it. Select **Get Info** from the File pull-down menu and set the memory size to 1024K.)
- Do not press the reset or interrupt switch while the RAM test is running. Pushing reset causes the RAM test to fail, and pressing interrupt could damage the *MacTest* disk.
- After completing the repair, always run *MacTest* to verify that there are no other faults.

Running MacTest

1. (**Macintosh Portable only**) Plug in the power adapter and connect it to the Portable.
2. Connect the following loopback equipment:
   - For *MacTest Pro*: No loopbacks needed unless you're running the COMM Test TMOD. Use a serial loopback cable (mini DIN-8 cable) between serial ports when running the COMM Test TMOD.
   - Macintosh 128K/512K: DE-9 serial port plugs (2) to serial ports.
   - Macintosh Classic and IIci: SCSI loopback test card to SCSI port and serial loopback cable (mini DIN-8 cable) between serial ports.
3. (**Macintosh Portable only**) Reset the power manager by simultaneously depressing and then releasing the reset and interrupt switches.
4. Boot the *MacTest* disk.
5. Select tests from the Test Selections menu.
6. To loop on selected tests, select **Loop On Selected Tests** from the Test Selections window.
7. Click **Start.**

If you have any problems launching or running *MacTest Pro*, try the following:

- Turn off screen savers before running tests.
- Remove, disable, or turn off INITs, control panel devices (CDEVs), and desk accessories (DAs).
- If you're using System 7, turn off virtual memory and file sharing, or use the Memory Control Panel to put the machine into 32-bit addressing mode. Then restart the computer.
- Use the Chooser to set AppleTalk to Inactive, and then restart the computer.
- When using *Apple Video Cards Tests, Display Test Patterns*, or *Macintosh Quadra 700/900/950 Tests*, initialize the attached monitors by using the Monitors Control Panel.
- Do not launch or run other applications before, after, or while you are running diagnostic tests without restarting the machine.
- After running destructive tests, save the test log if desired, and then restart the computer. Do not print the test log or run any other application before you restart the computer.
- Run tests twice if there is any doubt about test results or any question about the operation of the computer
- Remove any test module files that aren't required.

If you need additional information, refer to the documentation that accompanies the *MacTest* program.

SCSI Loopback Jumper

The SCSI loopback card must be jumpered between J1 pin 25 and RP1 pin 14 in order to be used with *MacTest*. New loopback cards have the jumper etched into the card circuitry. Older versions of the card need the jumper installed.

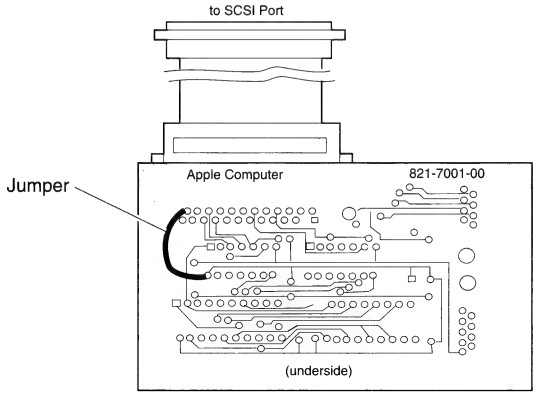


Figure 1 Older SCSI Loopback Card with Jumper

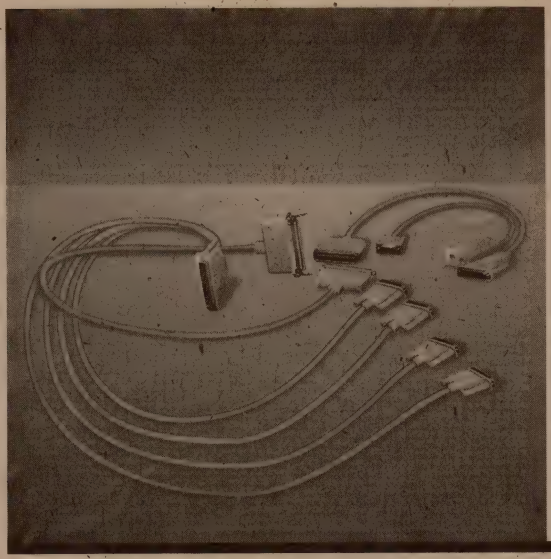
Determining If a Jumper Is Needed

1. Look at the part number on the back of the SCSI loopback card.
2. If the part number ends with the letter A, the jumper is included in the card circuitry.
3. If the part number ends with double zeros (00), check to see if the card has an external jumper installed from J1 pin 25 to RP1 pin 14. If there is no external jumper, install one.

Installing the Jumper

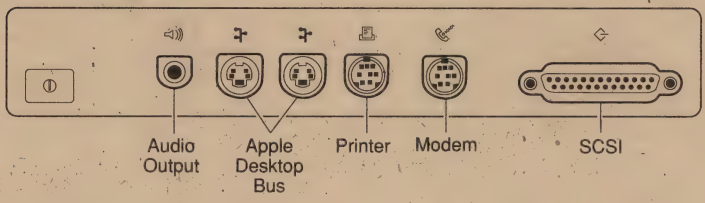
1. Locate J1 pin 25 and RP1 pin 14 on the SCSI loopback card (see Figure 1). J1 pin 25 is the pin closest to the upper-left corner of the card; RP1 pin 14 is in the middle line of pins and closest to the left edge of the card.
2. Solder a wire connection between J1 pin 25 and RP1 pin 14 on the SCSI loopback card.

Ports, Cables, and Pin-Outs

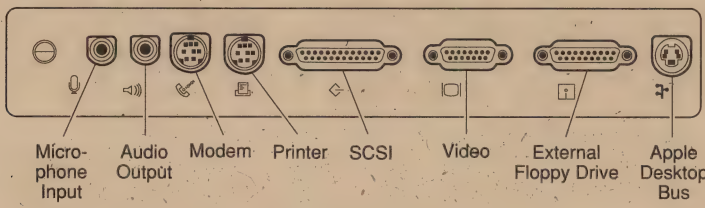


Computer Port Locations

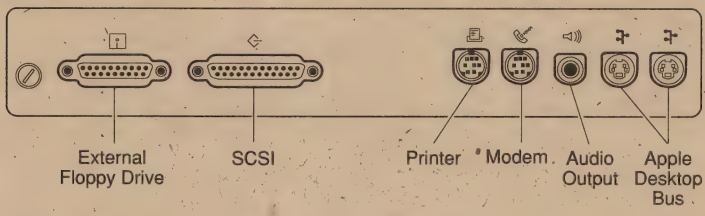
Macintosh II, IIx, IIfx



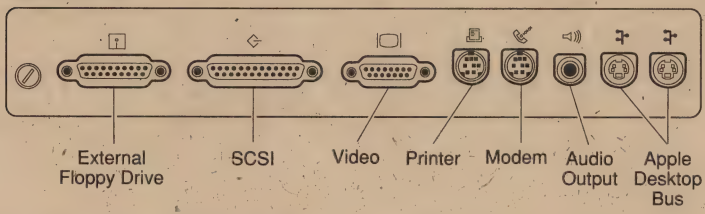
Macintosh IIsi



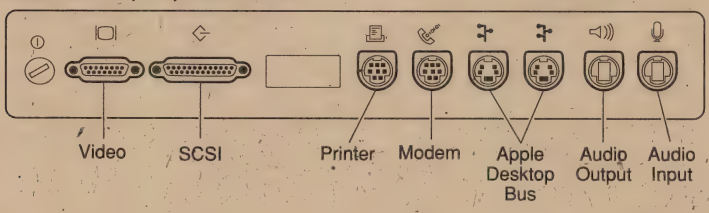
Macintosh IIcx

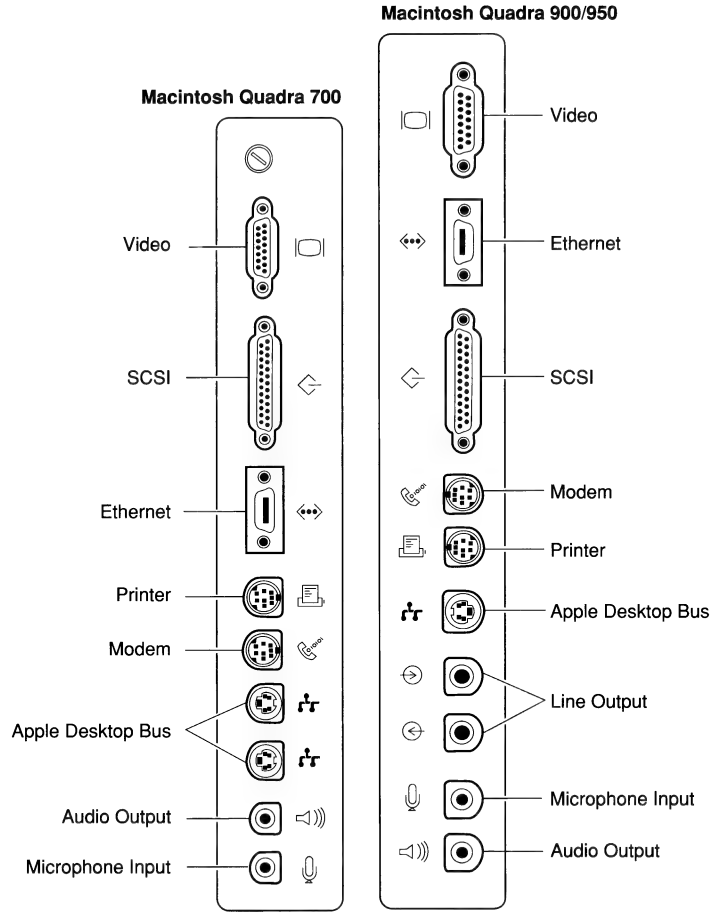


Macintosh IIci

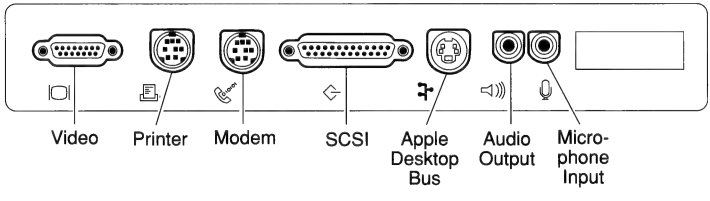


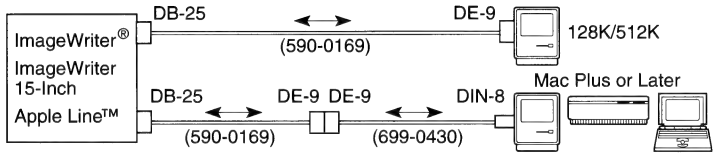
Macintosh IIvi, IIvx, Performa 600

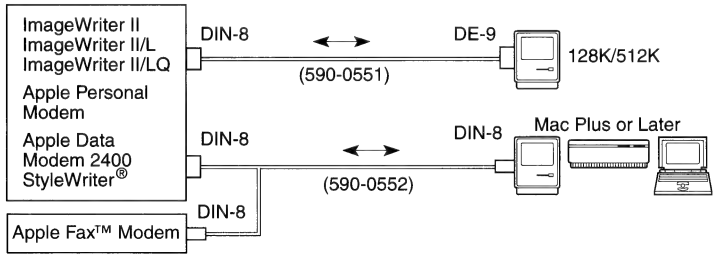


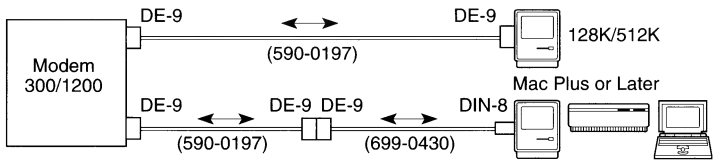


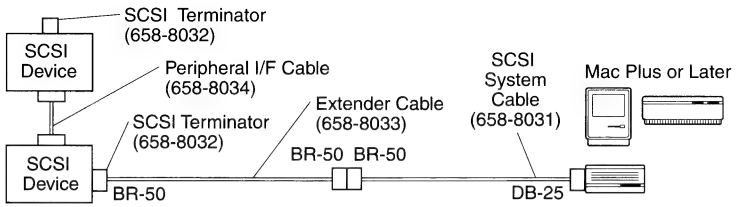
Macintosh LC, LC II, Performa 400

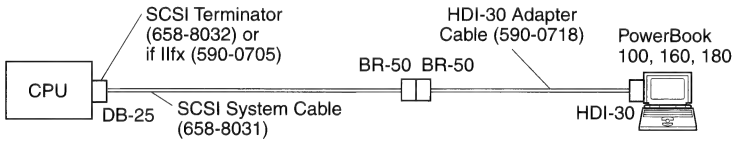


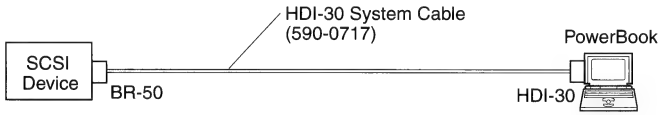

ImageWriter®
ImageWriter
15-Inch
Apple Line™
DB-25
(590-0169)
DE-9
128K/512K
DB-25
DE-9 DE-9
DIN-8
(590-0169)
(699-0430)
Mac Plus or Later


ImageWriter II
ImageWriter II/L
ImageWriter II/LQ
Apple Personal
Modem
Apple Data
Modem 2400
StyleWriter®
Apple Fax™ Modem
DIN-8
(590-0551)
DE-9
128K/512K
DIN-8
DIN-8
(590-0552)
Mac Plus or Later
DIN-8


Modem
300/1200
DE-9
(590-0197)
DE-9
128K/512K
DE-9
DE-9 DE-9
DIN-8
(590-0197)
(699-0430)
Mac Plus or Later


SCSI Terminator
(658-8032)
SCSI
Device
Peripheral I/F Cable
(658-8034)
SCSI Terminator
(658-8032)
Extender Cable
(658-8033)
SCSI
System
Cable
(658-8031)
Mac Plus or Later
SCSI
Device
BR-50 BR-50
BR-50
DB-25


SCSI Terminator
(658-8032) or
if IIfx (590-0705)
HDI-30 Adapter
Cable (590-0718)
PowerBook
100, 160, 180
CPU
BR-50 BR-50
DB-25
SCSI System Cable
(658-8031)
HDI-30

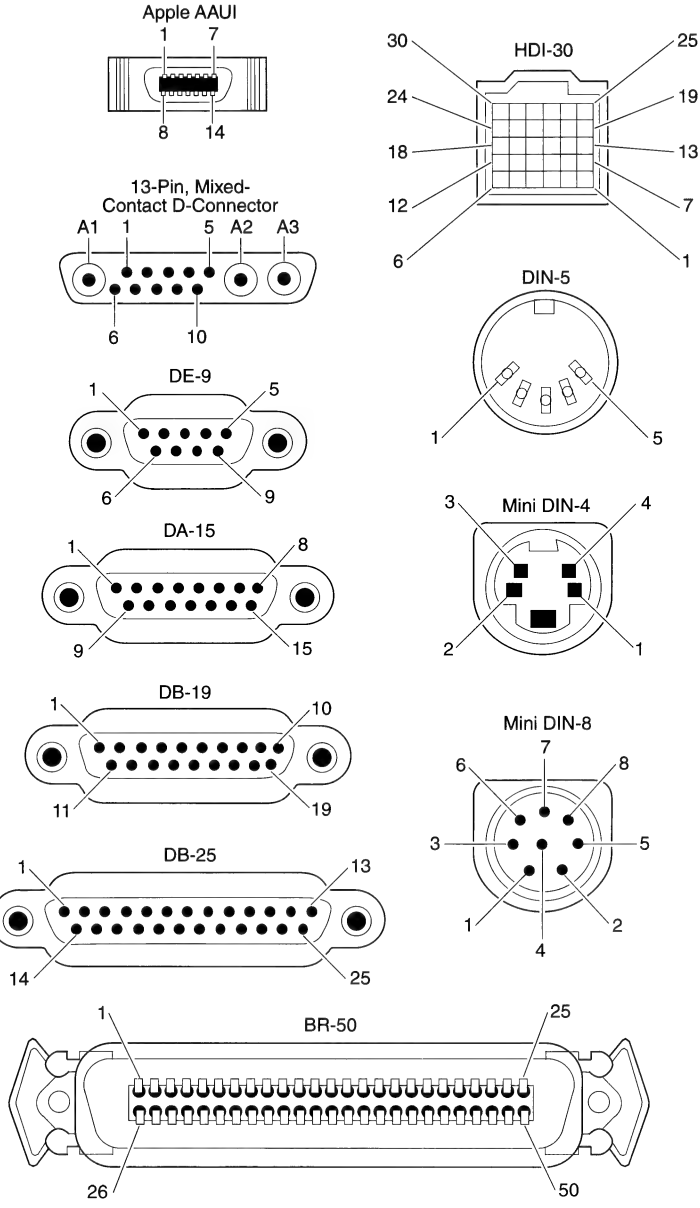

HDI-30 System Cable
(590-0717)
PowerBook
SCSI
Device
BR-50
HDI-30

Peripheral Cables

Device	Part Number (Macintosh 128K & 512K)	Part Number (Macintosh Plus & Later)	Cable Model Number	Cable Color	Cable Type
ImageWriter, ImageWriter 15-inch, AppleLine, Cluster Controller	590-0169	590-0169 and 699-0430 590-0553 or 590-0341	M0150 M0199 M0189	Medium Brown Smoke Beige	DE-9 to DB-25 Male to Male Mini DIN-8 to Mini DE-9 Male to Female (adapter cable)
ImageWriter II, II/L, II/LQ; Apple Personal Modem; Apple Data Modem 2400; StyleWriter	590-0551 or 590-0332	 590-0552 or 590-0340	M0196 M0185 M0197	Smoke Beige Smoke Beige	Mini DIN-8 to DE-9 Male to Male Mini DIN-8 to Mini DIN-8 Male to Male
AppleFax Modem		590-0552 or 590-0340	M0197	Smoke Beige	Mini DIN-8 to Mini DIN-8 Male to Male
Modem 300/1200	590-0197	590-0197 and 699-0430 590-0553 or 590-0341	M0170 M0199 M0189	Medium Brown Smoke Beige	DE-9 to DE-9 Male to Male Mini DIN-8 to Mini DE-9 Male to Female (adapter cable)
SCSI Devices (system cable)		658-8031 590-0305 or 590-0345	M0206	Smoke Beige	BR-50 to DB-25 Male to Male
SCSI Devices (terminator)		658-8032 590-0304 or 590-0344	M0209	Smoke Beige	BR-50
SCSI Devices (cable extender)		658-8033 590-0307 or 590-0347	M0208	Smoke Beige	BR-50 Male to Female
SCSI Devices (peripheral I/F cable)		658-8034 590-0306 or 590-0346	M0297	Smoke Beige	BR-50 Male to Male

Cable Connectors

The pin numbers shown below are for the connectors attached to the ends of the Macintosh peripheral cables, as viewed from the front of the connector.



External Video Connector		
Pin	**Signal Name**	**Signal Description**
1	RED.GND	Red video ground
2	RED.VID	Red video
3	CSYNC/	Composite sync
4	MON.ID1	Monitor ID, bit 1
5	GRN.VID	Green video
6	GRN.GND	Green video ground
7	MON.ID2	Monitor ID, bit 2
8	NC	No connection
9	BLU.VID	Blue video
10	MON.ID3	Monitor ID, bit 3
11	C&VSYNC GND	Composite & vertical sync ground
12	VSYNC/	Vertical sync
13	BLU.GND	Blue video ground
14	HSYNC.GND	Horizontal sync ground
15	HSYNC/	Horizontal sync
Shell	CHASSIS GND	Chassis ground

Connector type: DA-15 male

This connector is present on the Macintosh LC, LCII, Performa 400, IIci, IIsi, Quadra 700, Quadra 900/950, Macintosh Duo Dock, and Duo MiniDock.

The Macintosh Quadra 700 and Quadra 900/950 support all Apple-manufactured Macintosh monitors.

The Macintosh LC, LC II/Performa 400, IIvi, IIvx, and Performa 600 support all Apple-manufactured 12- and 13-inch monochrome and color monitors.

The Macintosh IIci and IIsi support all Apple-manufactured Macintosh monitors except the Macintosh Portrait Display, 21-Inch Color Display, and Two-Page Monochrome Monitor.

The PowerBook 160, 180 Duo Dock, and Duo MiniDock support all Apple-manufactured monitors, except the 21-Inch Color Display and Two-Page Monochrome Monitor.

SCSI Connector – DB-25		
Pin	**Signal Name**	**Signal Description**
1	REQ/	Request
2	MSG/	Message
3	I/O/	Input/output
4	RST/	Reset
5	ACK/	Acknowledge
6	BUSY/	Busy
7	GND	Signal ground
8	Data0/	Data bit 0
9	GND	Signal ground
10	Data3/	Data bit 3
11	Data5/	Data bit 5
12	Data6/	Data bit 6
13	Data7/	Data bit 7
14	GND	Signal ground
15	C/D/	Control/data
16	GND	Signal ground
17	ATN/	Attention
18	GND	Signal ground
19	SEL/	Select
20	PARITY/	Data parity
21	Data1/	Data bit 1
22	Data2/	Data bit 2
23	Data4/	Data bit 4
24	GND	Signal ground
25*	TERMPWR	+5 volts terminator power

Connector type: DB-25 male

This connector is present on all Macintosh computers (including the Duo Dock) except the 128K, 512K, 512K enhanced, and PowerBook series.

Total length of cables should not exceed 20 feet (6 meters).

CAUTION: This interface uses the same type of connector as a standard RS-232 serial interface but is electrically very different. DO NOT connect RS-232 devices or cables to this port. Doing so can damage the device and the computer.

*Terminator power is not provided on the Macintosh Plus or Portable.

Apple Desktop Bus Connector		
Pin	**Signal Name**	**Signal Description**
1	Data	Bidirectional data bus
2*	Power On/	Signal momentarily grounded to pin 4 to begin power-up sequence in CPU
3	Power	+5 volts
4	Ground	Signal ground

Connector type: Mini DIN-4 male

This connector is present on all Macintosh computers except the 128K, 512K, 512K enhanced, and Plus.

Total length of all cables should not exceed 16 feet (5 meters).

*On the Macintosh II family, Quadra 700 and 900, and PowerBook series only. Pin 2 is unused on all other models.

External Floppy Drive Connector – DB-19		
Pin	**Signal Name**	**Signal Description**
1	GND	Signal ground
2	GND	Signal ground
3	GND	Signal ground
4	GND	Signal ground
5	-12V	-12 volts DC
6	+5V	+5 volts DC
7	+12V	+12 volts DC
8	+12V	+12 volts DC
9	NC	No connection
10	PWM	Motor speed control
11	PH0	Command control line
12	PH1	Command control line
13	PH2	Command control line
14	PH3	Command control line
15	WRREQ/	Write request
16	HDSEL	Hand select
17	ENBL2/	Read line enable
18	RD	Read data
19	WR	Write data

Connector type: DB-19 male

This connector is present on the 128K, 512K, 512K enhanced, Plus, SE, SE/30, Classic, Classic II, Performa 200, Portable, IIcx, IIci, IIsi, IIvi, IIvx, and Performa 600.

A Macintosh 400K External Drive can be connected to the 128K, 512K, 512K enhanced, Plus, SE, and Portable.

A Macintosh 800K External Drive or an Apple 3.5" Drive can be connected to the 512K enhanced, Plus, SE, SE/30, Classic, Classic II, Performa 200, IIcx, IIci, IIsi, Portable, IIvi, IIvx, and Performa 600.

Connect an Apple SuperDrive to a Macintosh SE (FDHD upgrade), SE/30, Classic, Classic II, IIcx, IIci, IIsi, Portable, IIvi, IIvx, and Performa 600.

Connect a Hard Disk 20 to a Macintosh 512K, 512K enhanced, Plus, and SE.

Ethernet Connector		
Pin	**Signal Name**	**Signal Description**
1	FN Pwr	+12 volts @ 175 mA or +5 volts @ 420 mA
2	DI-A	Data In circuit A
3	DI-B	Data In circuit B
4	VCC	Voltage common
5	CI-A	Control In circuit A
6	CI-B	Control In circuit B
7	+5V	+5 volts (from host)
8	+5V	Secondary +5 volts (from host)
9	DO-A	Data Out circuit A
10	DO-B	Data Out circuit B
11	VCC	Secondary voltage common
12	NC	Reserved
13	NC	Reserved
14	FN Pwr	Secondary +12 volts or +5 volts
Shell	Protective Gnd	Protective ground
Connector type: Custom 14-pin .05 spaced ribbon This connector is present on the Macintosh Quadra 700 and Quadra 900.		

Audio Output Connector – Stereo*		
Pin	**Signal Name**	**Signal Description**
(Sleeve)	GND	Signal ground
(Tip)	Left	1-volt, peak-to-peak audio signal with an impedance of 47 ohms**; left channel
(Ring)	Right	1-volt, peak-to-peak audio signal with an impedance of 47 ohms; right channel

Connector type: Stereo miniature phone plug (3.6 mm)

This connector is present on the Macintosh SE/30, Classic, Classic II, Performa 200, II, IIx, IIfx, IIcx, IIci, Quadra 700, Quadra 900, Quadra 950, LC, LC II, Performa 400, IIsi, Portable, and PowerBook series (except the Duo 210/230).

The internal speaker is disabled when this connector is in use.

*The PowerBook 100 outputs a monaural signal on the left and right channels.

**The Macintosh Portable and PowerBook series produce a 0.75-volt, peak-to-peak signal.

Microphone Input Connector		
Pin	**Signal Name**	**Signal Description**
(Tip)	+8V	+8 volts for powering electret microphone*
(Ring)	Right	Audio input with a maximum amplitude of 20 mV at 600 ohms impedance
(Sleeve)	GND	Signal ground

Connector type: Stereo miniature phone plug (3.6 mm)

This connector is present on the Macintosh LC, LC II, Performa 400, IIsi, Classic II, Performa 200, IIvi, IIvx, Performa 600, Quadra 700, Quadra 900, Quadra 950, PowerBook 140,145,160,170,180, and Duo Dock.

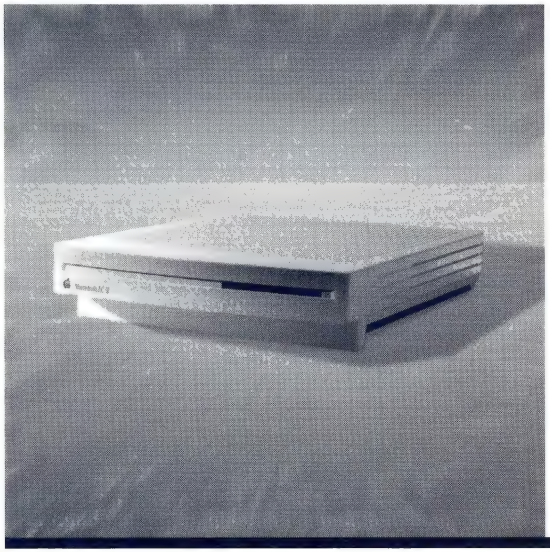
*Do not connect any device other than the Macintosh microphone into the microphone input connector. The connector provides +8 volts for the microphone. Connecting incompatible devices could damage the device or computer.

Line Input Connector			
Pin	**Signal Description**	**Pin**	**Signal Description**
(Sleeve)	Digital ground	(Tip)	Audio input

Connector type: RCA phono plug

This connector is presented on the Macintosh Quadra 900/950 only. Two connectors are provided–right and left channel. The stereo information will be internally mixed to yield a monaural signal.

Macintosh LC, LC II, and Performa 400



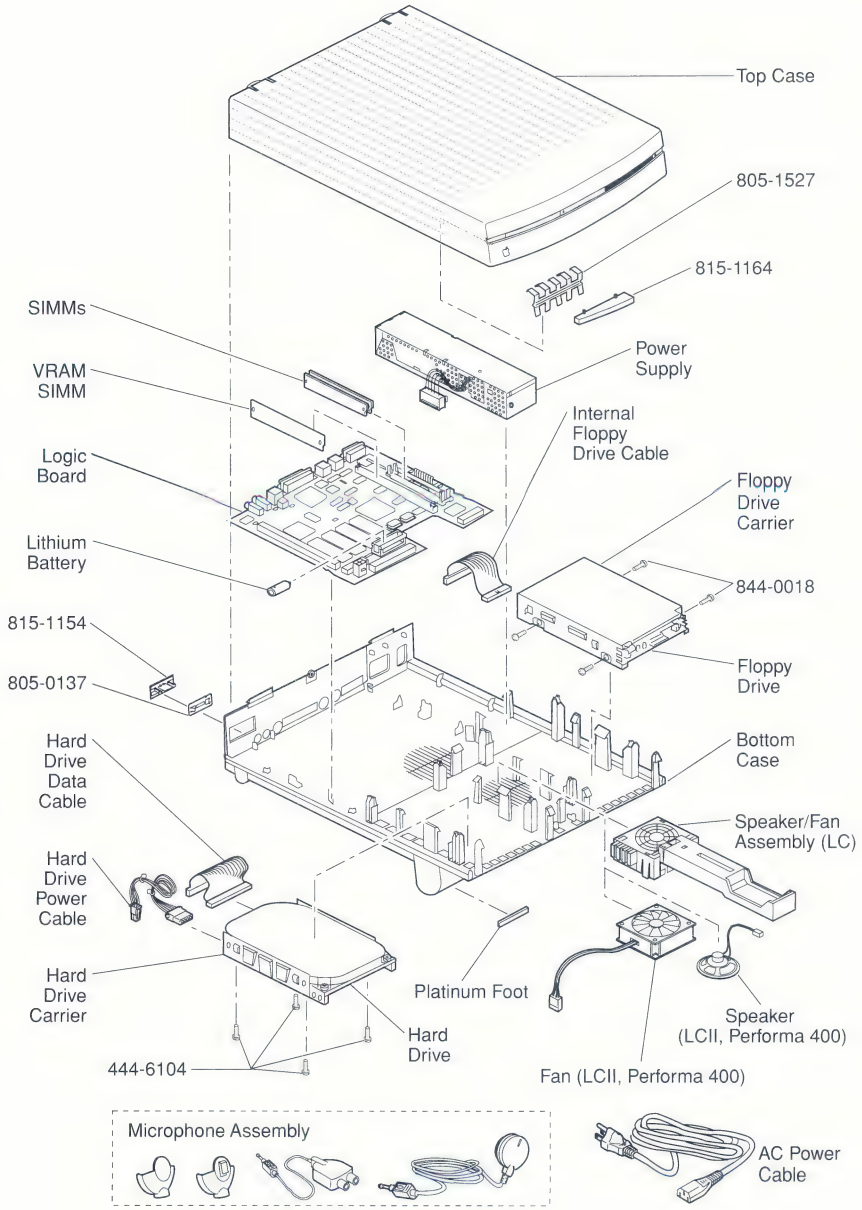


Figure 1 Macintosh LC, LC II, and Performa 400 Exploded View

Specifications

Processor	Macintosh LC: Motorola 68020 Macintosh LC II, Performa 400: Motorola 68030; burst mode RAM access 32-bit internal data bus 16 MHz clock speed 256-byte instruction and data cache
Memory	RAM (Macintosh LC): 2 MB RAM, expandable to 10 MB; 100 ns or faster SIMMs RAM (Macintosh LC II, Performa 400): 4 MB RAM, expandable to 10 MB; 100 ns or faster SIMMs ROM: 512K VRAM: 256K, upgradeable to 512K LC processor-direct slot: 96-pin processor-direct slot, supporting 020 direct slot expansion card
Disk Storage	Floppy drive: Internal 1.4 MB floppy drive; optional second 1.4 MB floppy drive on Macintosh LC Hard drive: Internal 40 MB hard drive; optional internal 80 MB hard drive
I/O Interfaces	ADB: One ADB port; mini DIN-4 connector Serial: Two RS-232/RS-422 serial ports; mini DIN-8 connectors SCSI: SCSI interface; DB-25 connector Video: One DB-15 monitor port for built-in video; DA-15 connector Sound: Sound input port for monaural sound input; mini phone plug
I/O Devices	Keyboard: Apple Keyboard, Apple Keyboard II, or Apple Extended Keyboard II; uses ADB port; mini DIN-4 connector Mouse: ADB mouse; mini DIN-4 connector
Sound and Video	Sound: Monaural, 8-bit sound input with Macintosh Audio Compression Expansion (MACE) sound utility supporting 3 to 1 or 6 to 1 compression; monophonic, 8-bit sound generator supplying same signal to both channels of stereo equipment; omnidirectional electret microphone Video: Built-in video supports Apple High Resolution Monochrome, AppleColor High-Resolution RGB, Macintosh 12" RGB Display, Macintosh 12" Monochrome Display, and Macintosh Color Display monitors
Electrical	Line voltage: 100–240 VAC, automatically configured Frequency: 50–60 Hz Maximum power: 50 W, not including monitor power
Physical	Height: 3 in. (7.7 cm) Width: 12.2 in. (31 cm) Depth: 15 in. (38.2 cm) Weight: 8.8 lb. (4 kg)

Symptom/Cure Chart

System Problems	Solutions
Doesn't power on—screen is black, fan is not running, and LED is not lit	1. Check cables. 2. Plug monitor directly into wall socket, and verify that monitor has power. 3. Replace power cord. 4. Replace power supply. 5. Replace logic board. Move customer's SIMMs to new logic board.
System shuts down intermittently	1. Make sure air vents on top and sides of cover are clear. Thermal protection circuitry may shut down system. After 30-40 minutes, system should be OK. 2. Replace power cable. 3. Replace power supply. 4. Replace logic board. Move customer's SIMMs to new logic board.
Clicking, chirping, or thumping sound	1. Replace power supply. 2. Disconnect hard drive; replace drive if noise disappears. 3. Replace logic board. Move customer's SIMMs to new logic board.
System intermittently crashes or locks up	1. Make sure System is version 6.0.7 or later (Mac LC), or version 7.0 or later (Mac LC II and Performa 400). 2. Make sure you have known-good application software. 3. Replace system software. 4. Replace logic board. Move customer's SIMMs to new logic board. 5. Replace SIMMs. 6. Replace power supply.
System intermittently doesn't power on	1. Check cables. 2. Plug monitor directly to wall socket and verify that monitor has power. 3. Replace power cord. 4. Replace power supply. 5. Replace logic board. Move customer's SIMMs to new logic board.
System seems to boot, then message "Finder is old version" displays	1. Clear parameter RAM. (System 6: Hold down <Shift> <Option> <Command> keys and select **Control Panel** from Apple menu. Reset mouse controls. System 7: Hold down <Command> <Option> <P> <R> keys and reboot system.) 2. Replace logic board. Retain customer's SIMMs.
Video Problems	**Solutions**
Screen is completely dark, fan is not running, and LED is not lit	1. Plug monitor directly into wall socket, and verify that monitor has power. 2. Remove expansion card, if installed. 3. Remove any external peripherals, if attached. 4. Replace logic board. Move customer's SIMMs to new logic board. 5. Replace power supply.

Screen is dark, no audio, no drive, but fan is running and boot tone is normal	1. Adjust brightness on monitor. 2. Replace monitor. 3. Replace video cable. 4. Replace VRAM SIMM. 5. Replace SIMMs. 6. Replace logic board. Move customer's SIMMs to new logic board. 7. Replace power supply.
Vertical or horizontal lines or snow appear on screen; or screen is completely dark, and boot tone is normal	1. Replace monitor. 2. Replace video cable. 3. Replace VRAM SIMM. 4. Replace logic board. Move customer's SIMMs to new logic board. 5. Replace power supply.
Partial or whole screen is bright and audio is present, but no video information is visible	1. Replace monitor. 2. Replace video cable. 3. Replace logic board. Move customer's SIMMs to new logic board.
Screen is dark, audio and drive operate, fan is running, and LED is lit	1. Adjust brightness on monitor. 2. Replace monitor. 3. Replace video cable. 4. Replace VRAM SIMM. 5. Replace logic board. Move customer's SIMMs to new logic board. 6. Replace power supply.

Drive Problems	**Solutions**
Audio and video are present, but internal drive doesn't operate	1. Replace bad disk. 2. Verify that all external SCSI devices are disconnected. 3. Replace internal drive cable. 4. Replace internal drive. 5. Replace logic board. Move customer's SIMMs to new logic board. 6. Replace power supply.
Disk ejects; display shows icon with blinking "X"	1. Replace disk with known-good system disk. 2. Replace internal drive cable. 3. Replace internal drive. 4. Replace logic board. Move customer's SIMMs to new logic board.
System won't eject disk	1. Switch power off and hold mouse button down while switching power back on. 2. Eject disk manually by pushing opened paper clip into hole beside the drive slot. 3. Replace drive cable. 4. Replace drive.
System attempts to eject disk but can't	1. Try pushing disk completely back in. 2. Eject disk manually by pushing opened paper clip into hole beside the drive slot. 3. Check that cover is on completely. 4. Replace drive.

SCSI Problems	Solutions
Internal hard drive runs continuously	1. Replace hard drive data cable. 2. Replace hard drive. 3. Replace logic board. Move customer's SIMMs to new logic board.
Internal hard drive won't operate	1. Replace hard drive data cable. 2. Replace hard drive power cable. 3. Replace hard drive. 4. Replace logic board. Move customer's SIMMs to new logic board.

Peripheral Problems	Solutions
Works with internal or external SCSI device but not with both	1. Check that switch setting of external SCSI device is different priority from that of internal device. 2. Replace terminator on external device. 3. Verify that terminator is installed on internal SCSI drive. 4. Replace SCSI device select cable.
Cursor doesn't move	1. Reboot system. 2. Check mouse connection. 3. If mouse was connected to keyboard, connect it to rear ADB port. If mouse works, replace keyboard. If mouse does not work in ADB port, replace mouse. 4. Replace logic board. Move customer's SIMMs to new logic board.
No response to any key on keyboard	1. Make sure System is version 6.0.7 or higher (LC), or 7.0 or higher (LC II and Performa 400). 2. Check keyboard connection to ADB port. 3. Replace keyboard cable. 4. Replace keyboard. 5. Replace logic board. Move customer's SIMMs to new logic board.
Known-good ImageWriter or ImageWriter II won't print	1. Make sure that Chooser and Control Panel are set correctly. 2. Make sure System is version 6.0.7 or higher (LC), or 7.0 or higher (LC II and Performa 400). 3. Replace printer interface cable. 4. Replace logic board. Move customer's SIMMs to new logic board.
Known-good LaserWriter won't print	1. Make sure that Chooser and Control Panel are set correctly. 2. Make sure System is version 6.0.7 or higher (LC), or 7.0 or higher (LC II and Performa 400). 3. Refer to Networks manual on *Service Source*.
Cursor moves but clicking mouse button has no effect	1. Replace mouse. 2. Replace logic board. Move customer's SIMMs to new logic board.

Can't double-click to open an application, disk, or server	1. Remove duplicate system files on hard drive. 2. Clear PRAM. (System 6: Hold down <Shift> <Option> <Command> keys and select **Control Panel** from Apple menu. Reset mouse controls. System 7: Hold down <Command> <Option> <P> <R> keys during startup but before "Welcome to Macintosh" appears. You'll hear normal startup chords and about two seconds later, you'll hear another chord. This means PRAM has been cleared.) 3. If mouse was connected to keyboard, connect it to rear ADB port. If mouse works, replace keyboard. If mouse does not work in ADB port, replace mouse. 4. Replace logic board. Move customer's SIMMs to new logic board.

Miscellaneous Problems	**Solutions**
No sound from speaker	1. Verify that volume setting in Control Panel is set to 1 or above. 2. Replace speaker. 3. Replace logic board. Move customer's SIMMs to new logic board.
Clock not running	1. Replace battery. 2. Replace logic board. Move customer's SIMMs to new logic board.
System hangs or crashes (Mac LC II)	– If using an older Macintosh Ethernet card on a Macintosh LC II computer, disable virtual memory.
System doesn't recognize more than 10 MB of RAM (Mac LC II)	– Although you can install up to 12 MB of RAM in a Macintosh LC II computer, 10 MB is the maximum amount of RAM that the system recognizes.

Macintosh LC RAM Upgrade

The Macintosh LC comes with 2 MB of RAM soldered to the logic board in bank A and two SIMM slots for expansion memory. You can expand RAM to 10 MB, but only 1 MB RAM SIMMs are currently available for the Macintosh LC. When you expand system memory, fill both expansion slots with SIMMs of the same size. You can mix SIMMs of different speeds, as long as both SIMMs are 100 ns or faster.

Note Use the SIMM removal tool when removing SIMMs from the logic board. See "Special Tools Index" in the General Information section.

Macintosh LC Memory Configurations

Total RAM	Bank A	RAM SIMM Slots
2 MB	2 MB soldered RAM	Empty
4 MB	2 MB soldered RAM	Two 1 MB SIMMs
6 MB	2 MB soldered RAM	Two 2 MB SIMMs
10 MB	2 MB soldered RAM	Two 4 MB SIMMs

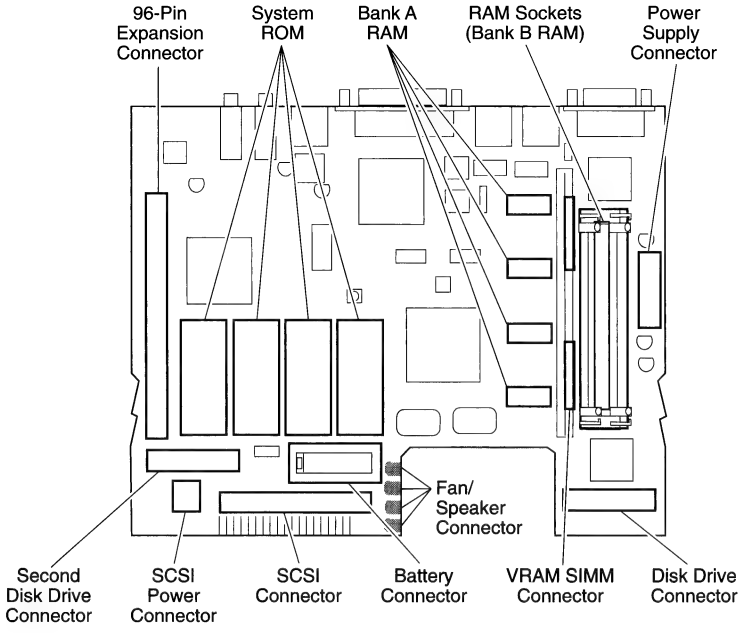


Figure 2 Macintosh LC Logic Board

Macintosh LC II and Performa 400 RAM Upgrade

The Macintosh LC II and Performa 400 come with 4 MB of RAM soldered to the logic board in bank A and two SIMM slots for expansion memory. You can expand system memory to 10 MB. To expand system memory, both expansion slots must be filled with SIMMs of the same size. You can mix SIMMs of different speeds, as long as both SIMMs are 80 ns or faster.

Note Use the SIMM removal tool when removing SIMMs from the logic board. See "Special Tools Index" in the General Information section.

Macintosh LC II and Performa 400 Memory Configurations

Total RAM	Bank A	RAM SIMM Slots
4 MB	4 MB soldered RAM	Empty
6 MB	4 MB soldered RAM	Two 1 MB SIMMs
8 MB	4 MB soldered RAM	Two 2 MB SIMMs
10 MB	4 MB soldered RAM	Two 4 MB SIMMs

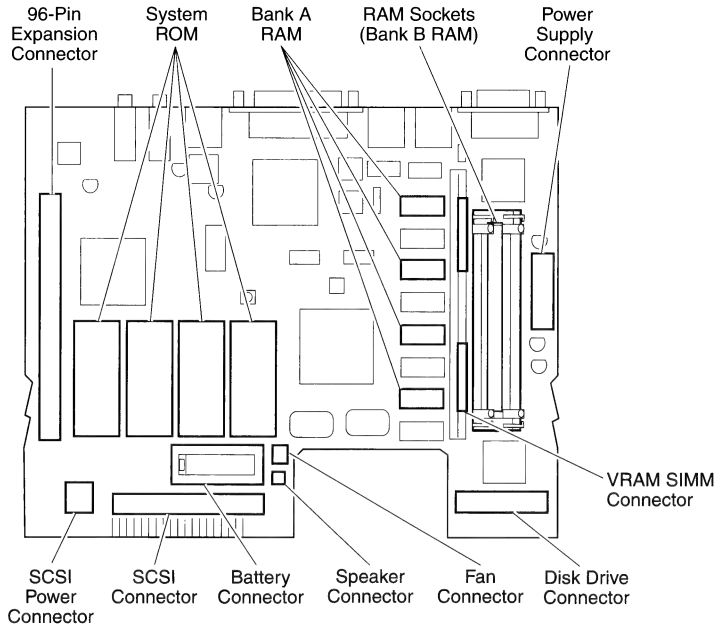


Figure 3 Macintosh LC II and Performa 400 Logic Board

Macintosh II, IIx, and IIfx

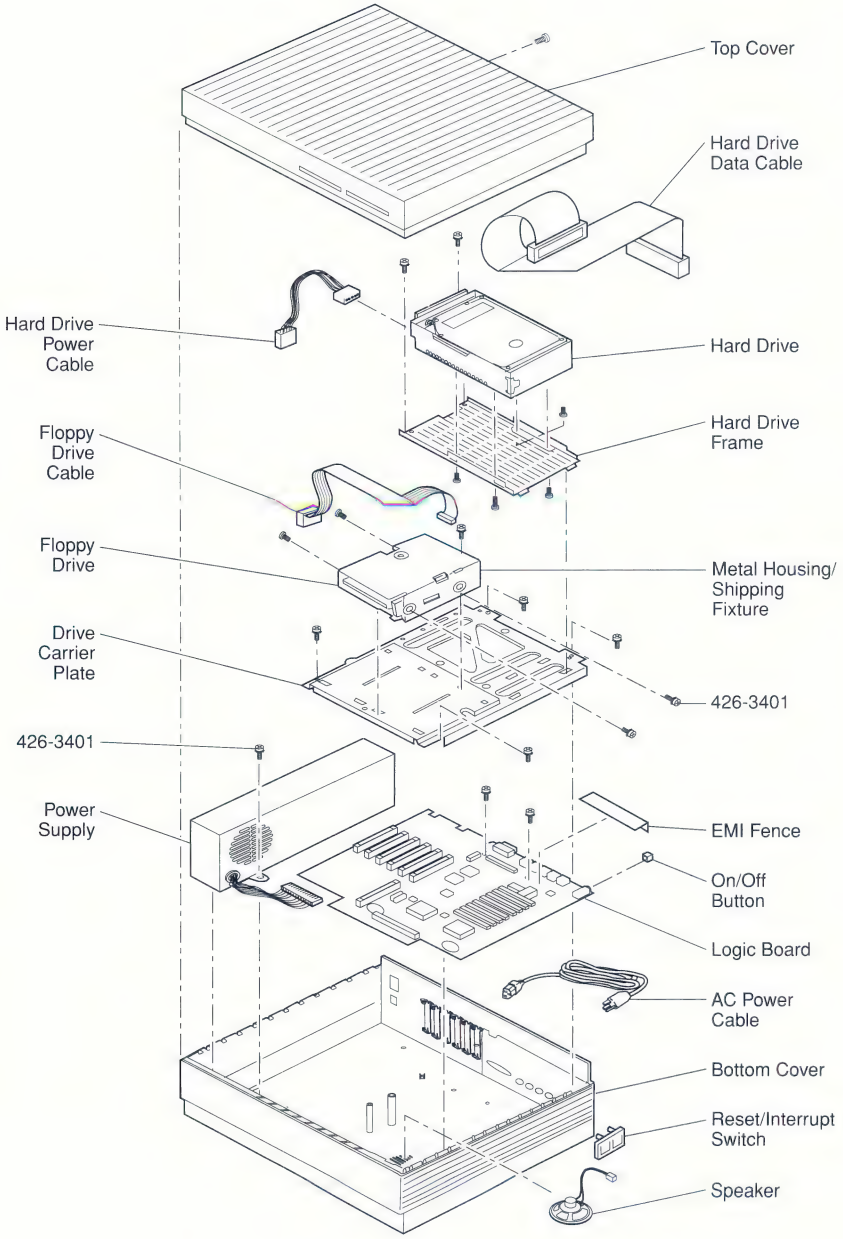


Figure 1 Macintosh II, IIx, and IIfx Exploded View

ROM, low, Macintosh II FDHD upgrade 661-0642
ROM, med low, Macintosh II FDHD upgrade 661-0641
ROM, med high, Macintosh II FDHD upgrade 661-0640
ROM, high, Macintosh II FDHD upgrade 661-0639
SIMM, 256K, 120 ns 661-0402
SIMM, DIP, 256K, 120 ns 661-0494
SIMM, 1 MB, 120 ns 661-0403
SIMM, DIP, 1 MB, 120 ns 661-0410
Logic board, Macintosh IIx (w/o RAM; replaces 661-0463) 661-0529
Battery holder board (2 pack) 600-0530
SIMM, 256K, 120 ns 661-0402
SIMM, DIP, 256K, 120 ns 661-0494
SIMM, 1 MB, 120 ns 661-0403
SIMM, DIP, 1 MB, 120 ns 661-0410
Logic board, Macintosh IIfx (w/o RAM) 661-0522
Battery holder cover 520-0344
Internal SCSI terminator block 590-4515
Internal SCSI filter 590-4516
SIMM, 1 MB, SOJ, 80 ns, 64-pin 661-0548
Logic board, parity, Macintosh IIfx (w/o RAM) 661-0592
Battery holder cover 520-0344
SIMM, 1 MB, SOJ, 60 ns, 64-pin, parity 661-0549
Logic board parts
EMI fence 805-5070
Lithium battery (w/o leads; replaces 742-0009) 742-0011
On/Off button 815-6237
Screws (logic board mounting) 462-4100
Mouse, ADB (replaces 661-0338) 661-0479
Power supply, Macintosh II/IIx 661-0375
Power supply, Macintosh IIfx 661-0542
Screw, M 3 x 6, with two washers 462-3401
Top cover and latch assembly 630-5229

Specifications—Macintosh II

Processor	Motorola 68020 microprocessor; 15.6772 MHz; 32-bit internal architecture Coprocessor: Motorola 68881 floating-point unit (FPU) Addressing: 32-bit registers; 32-bit address bus; 32-bit data bus
Memory	RAM: 1 MB, expandable to 8 MB; 120 ns or faster SIMMs ROM: 256K (four 512K-by-8-bit DIP devices) PRAM: 256 bytes
Disk Storage	Floppy drive: Internal 800K floppy drive; optional second internal 800K floppy drive; optional internal 1.4 MB floppy drive upgrade Hard drive: Optional internal 40, 80, or 160 MB hard drive
I/O Interfaces	ADB: Two ADB ports; low-speed, synchronous serial interface Serial: Two RS-232/RS-422 serial ports; 230.4 Kbaud max.; 0.92 Mbit/sec if external clock source is provided; asynchronous, synchronous, and AppleTalk protocols supported SCSI: 5 MB/sec transfer rate; eight devices max.; 50-pin internal connector; DB-25 external connector Floppy drive: Apple IWM chip; GCR modes to support 800K drives Slot expansion: Processor-direct card slot
Sound	Output impedance of 8–600 ohms; short-circuit protected; sound-out jack disables internal speaker when in use; four-voice, wavetable synthesis and stereo sampling generator
Electrical	Line voltage: 90–140 VAC; 170–240 VAC, automatically configured Frequency: 48–62 Hz, single phase Maximum power: 220 W (not including monitor power)
Physical	Height: 5.51 in. (14 cm) Width: 18.66 in. (47.4 cm) Depth: 14.37 in. (36.5 cm) Weight: 24–26 lb. (10.9–11.8 kg); weight varies with configuration of RAM, floppy drives, hard drives, and expansion cards

Specifications—Macintosh IIx

Processor	Motorola 68030 microprocessor; 15.6772 MHz; built-in paged memory management unit (PMMU); 256-byte instruction and data caches Addressing: 32-bit registers; 32-bit address bus; 32-bit data bus
Memory	RAM: 1 MB, expandable to 8 MB; 100 ns or faster SIMMs ROM: 256K (four 512K-by-8-bit SOJ devices on a ROM SIMM) PRAM: 256 bytes
Disk Storage	Floppy drive: Internal 1.4 MB floppy drive; optional second internal 1.4 MB floppy drive Hard drive: Optional internal 40, 80, or 160 MB hard drive
I/O Interfaces	ADB: Two ADB ports; low-speed, synchronous serial interface Serial: Two RS-232/RS-422 serial ports; 230.4 Kbaud max.; 0.92 Mbit/sec if external clock source is provided; supports asynchronous, synchronous, and AppleTalk protocols SCSI: 5 MB/sec transfer rate; eight devices max.; 50-pin internal connector; DB-25 external connector External drive: Apple SWIM chip; MFM/GCR modes to support 800K and 1.4 MB drives Slot expansion: 120-pin processor-direct slot (PDS)
Sound	Output impedance of 8–600 ohms; short-circuit protected; disables internal speaker when in use; four-voice, wavetable synthesis and stereo sampling generator
Electrical	Line voltage: 100–240 VAC; automatically configured Frequency: 48–62 Hz, single phase Maximum power: 220 W (not including monitor power)
Physical	Height: 5.51 in. (14 cm) Width: 18.66 in. (47.4 cm) Depth: 14.37 in. (36.5 cm) Weight: 24–26 lb. (10.9–11.8 kg); weight varies with configuration of RAM, floppy drives, hard drives, and expansion cards

Specifications—Macintosh IIfx

Processor	Motorola 68030 microprocessor; 40 MHz; 32-bit internal architecture; built-in paged memory management unit (PMMU); burst-mode RAM access; 256-byte, built-in instruction and data caches Coprocessor: Motorola 68882 floating-point unit (FPU); 40 MHz Input/output processor chips: Two IOP chips are standard implementations of a 2 MHz 6502; IOP chips manage the floppy drives (SWIM chip), ADB, and serial ports (SCC chip) SCSI/DMA controller: Standard cell implementation of 53C80 SCSI chip and DMA logic; manages the SCSI bus
Memory	RAM: 4 MB, expandable to 8 MB; 80 ns fast-page mode, 64-pin SIMMs Static RAM cache: Built-in, zero-wait-state, 32K static RAM cache memory architecture Memory subsystem: Supports overlapping reads form cache/ROM and writes to DRAM
Disk Storage	Floppy drive: Internal 1.4 MB floppy drive; optional second internal 1.4 MB floppy drive Hard drive: Optional internal 40, 80, or 160 MB hard drive
I/O Interfaces	ADB: Two ADB ports; allow daisy-chaining of ADB devices Serial: Two RS-232/RS-422 serial ports; mini DIN-8 connectors SCSI: 50-pin internal connector; DB-25 external connector NuBus: Six internal NuBus slots support full 32-bit address and data buses Processor-direct slot: Provides high-speed, 32-bit access to the system bus Sound: Stereo sound jack
Sound	Custom, digital sound chip provides 8-bit stereo sampling at 44.1 KHz and includes four-voice, wavetable synthesis—capable of driving stereo headphones or other stereo equipment through the sound jack
Electrical	Line voltage: 100–240 VAC, automatically configured Frequency: 48–62 Hz, single phase Maximum power: 230 W (not including monitor power)
Physical	Height: 5.5 in. (14 cm) Width: 18.7 in. (47.4 cm) Depth: 14.4 in. (36.5 cm) Weight: 24 lb. (10.9 kg) (without hard drive)

Symptom/Cure Chart

System Problems	Solutions
Doesn't power on, screen is black, fan is not running, and LED is not lit	1. Check cables. 2. Plug monitor directly into wall socket and verify that monitor has power. 3. Replace power cable. 4. Check batteries. Replace both batteries if either battery is below 3.2 volts. 5. Replace power supply. 6. Replace logic board. Move customer's SIMMs to new logic board.
Clicking, chirping, or thumping sound	1. Replace power supply. 2. Replace logic board. Move customer's SIMMs to new logic board.
Computer shuts down intermittently	1. Check that air vents on sides and top of computer are clear. Thermal protection circuitry may shut system down. After 30 to 40 minutes, system should be OK. 2. Replace power cable. 3. Check batteries. Replace both batteries if either battery is below 3.2 volts. 4. Replace power supply. 5. Replace logic board. Move customer's SIMMs to new logic board.
System intermittently crashes or locks up	1. Make sure system software is correct version. 2. Make sure you are using known-good software. 3. Replace SIMMs. 4. Replace logic board. Move customer's SIMMs to new logic board. 5. Replace power supply.
Error chords sound at startup (Macintosh IIfx only)	1. Replace Apple-labeled NEC SIMMs that have a date code of 9052 or lower. 2. See Startup Problems—Flowchart 2 in the On-Site Troubleshooting section.
System doesn't boot (Macintosh IIfx only)	– Replace Apple-labeled NEC SIMMs that have a date code of 9052 or lower.

Video Problems	Solutions
Partial or whole screen is bright and audio is present, but no video information is visible	1. Replace monitor. 2. Replace video cable. 3. Move video card to different slot. 4. Replace video card. 5. Replace logic board. Move customer's SIMMs to new logic board.
Screen is completely dark, fan is not running, and LED is not lit	1. Plug monitor directly into wall socket and verify that monitor has power. 2. Check batteries. Replace both batteries if either battery is less than 3.2 volts. 3. Replace power supply. 4. Replace logic board. Move customer's SIMMs to new logic board.

Screen is black, audio and drive operate, fan is running, and LED is lit	1. Adjust brightness on monitor. 2. Replace monitor. 3. Replace video cable. 4. Move video card to different slot. 5. Replace video card. 6. Replace SIMMs. 7. Replace logic board. Move customer's SIMMs to new logic board. 8. Replace power supply.
Screen is black, audio and drive don't operate, but fan is running and LED is lit	1. Replace video cable. 2. Move video card to different slot. 3. Replace video card. 4. Replace SIMMs. 5. Replace logic board. Move customer's SIMMs to new logic board. 6. Replace power supply. 7. Replace monitor.
Video display exhibits ghosting, or system boots and then loses video	– Replace Apple-labeled NEC SIMMs that have a date code of 9052 or lower.

Floppy Drive Problems
Solutions

Internal floppy drive runs continuously	1. Replace bad disk. 2. Replace internal floppy drive cable. 3. Replace internal floppy drive. 4. Replace logic board. Move customer's SIMMs to new logic board.
Audio and video are present, but one internal floppy drive doesn't operate	1. Replace bad disk. 2. Verify that all external SCSI devices are disconnected. 3. Replace internal floppy drive cable. 4. Replace internal floppy drive. 5. Replace logic board. Move customer's SIMMs to new logic board. 6. Replace power supply.
Audio and video are present, but neither internal drive operates	1. Replace bad disk. 2. Verify that all external SCSI devices are disconnected. 3. Replace power supply. 4. Replace logic board. Move customer's SIMMs to new logic board.
Disk ejects; icon with blinking "X" displays	1. Replace disk with known-good system disk. 2. Replace internal floppy drive cable. 3. Replace internal floppy drive. 4. Replace logic board. Move customer's SIMMs to new logic board.
Won't eject disk	1. Switch power off and hold mouse button down while switching power back on. 2. Eject disk manually by pushing opened paper clip into hole beside drive slot. 3. Replace internal floppy drive.

MS-DOS drive doesn't recognize disk formatted on 1.4 MB SuperDrive	– Reformat disk using MS-DOS drive.
Drive attempts to eject disk but can't	1. Reinsert disk. 2. Reseat cover so drive slots align correctly. 3. Eject disk manually by pushing opened paper clip into hole beside drive slot. 4. Replace internal floppy drive.

SCSI Drive Problems	**Solutions**
Internal hard drive won't operate, LED doesn't light, drive doesn't spin	1. Replace SCSI signal cable. 2. Replace SCSI power cable. 3. Replace hard drive. 4. Replace logic board. Move customer's SIMMs to new logic board.
Drive doesn't appear on desktop	– If computer is a Macintosh IIfx, there may be a SCSI termination problem. Refer to "SCSI Termination—Macintosh IIfx" to verify that computer is properly terminated.
Works with internal or external SCSI device but not with both	1. Check SCSI device switch setting on external device. Make sure setting isn't 0 (internal hard drive address) or 7 (CPU address). 2. If computer is a Macintosh IIfx, there may be a SCSI termination problem. Refer to "SCSI Termination—Macintosh IIfx" to verify that computer is properly terminated. 3. Replace SCSI terminator on external device. 4. Verify that terminator is installed on internal SCSI drive. 5. Troubleshoot external drive.

Peripheral Problems	**Solutions**
No response to any key on keyboard	1. Check keyboard connection to ADB port. 2. Replace keyboard cable. 3. Replace keyboard. 4. Replace logic board. Move customer's SIMMs to new logic board.
Cursor doesn't move	1. Check mouse connection. 2. Clean mouse. 3. If mouse was connected to keyboard, connect mouse to rear ADB port. If mouse works, replace keyboard. If mouse does not work in any ADB port, replace mouse. 4. Replace logic board. Move customer's SIMMs to new logic board.
Cursor moves, but clicking mouse button has no effect	1. Replace mouse. 2. Replace logic board. Move customer's SIMMs to new logic board.

Cannot double-click to open application, disk, or server	1. Remove any multiple system files on hard drive. 2. Clear parameter RAM. Reset mouse controls. 3. If mouse was connected to keyboard, connect it to rear ADB port. If mouse works, replace keyboard. If mouse does not work in any ADB port, replace mouse. 4. Replace logic board. Move customer's SIMMs to new logic board.
Known-good ImageWriter or ImageWriter II won't print	1. Verify system software is correct version. 2. Verify Chooser and Control Panel settings are correct. 3. Replace printer interface cable. 4. Replace logic board. Move customer's SIMMs to new logic board.
Known-good LaserWriter won't print	1. Verify system software is correct version. 2. Verify Chooser and Control Panel settings are correct. 3. Refer to Networks manual in *Service Source*.

Miscellaneous Problems	**Solutions**
No sound from speaker	1. Verify that volume setting in Control Panel is 1 or above. 2. Replace speaker. 3. Replace logic board. Move customer's SIMMs to new logic board.
HMMU socket doesn't allow PMMU installation	– Replace logic board. Verify HMMU socket on new logic board is 13-by-13 grid array package and that it contains 132 gold contacts inside socket. (Sockets containing 70 pins do not support PMMUs.)
System hangs when first application is launched, or displays error code and locks up (Macintosh IIfx only)	– Replace Apple-labeled NEC SIMMs that have a date code of 9052 or lower.

Macintosh II and IIx Memory Upgrades

The Macintosh II and IIx computers require 120 ns (or faster) SIMMs. The 150 ns SIMMs will cause serious timing problems. All SIMMs in each bank must be the same size. Mitsubishi 1 MB SIMMs, which are labeled "For 030 Systems Only," should be used only in systems with 68030 microprocessors.

Macintosh II/IIx Memory Configurations

Total RAM	Bank A	Bank B
1 MB	Four 256K SIMMs	Empty
2 MB	Four 256K SIMMs	Four 256K SIMMs
4 MB	Four 1 MB SIMMs	Empty
5 MB	Four 1 MB SIMMs	Four 256K SIMMs
8 MB	Four 1 MB SIMMs	Four 1 MB SIMMs

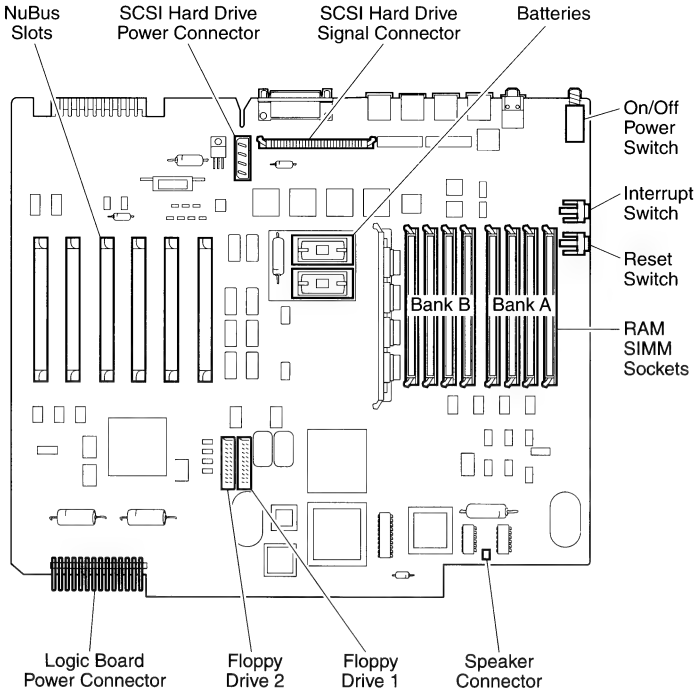


Figure 2 Macintosh II and IIx Logic Board

The Macintosh IIfx computer requires 80 ns (or faster) SIMMs. Do not use LaserWriter II SIMMs in the Macintosh IIfx.

Macintosh IIfx Memory Configurations

Total RAM	Bank A	Bank B
4 MB	Four 1 MB SIMMs	Empty
8 MB	Four 1 MB SIMMs	Four 1 MB SIMMs

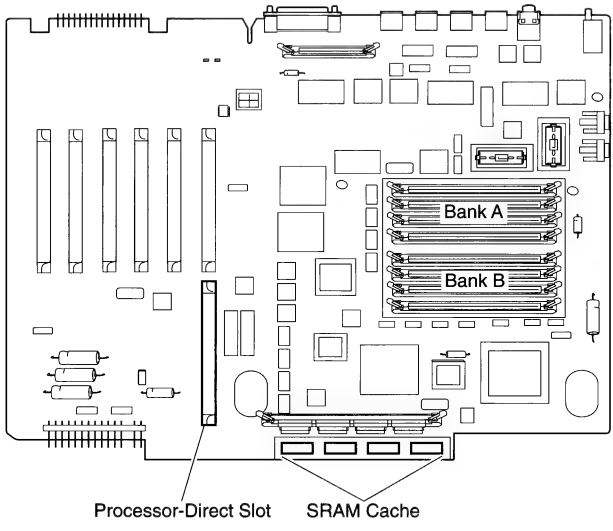


Figure 3 Macintosh IIfx Logic Board

Apple SuperDrive Upgrade

System software must be version 6.0.2 or higher to use the 1.4 MB Apple SuperDrive. If the software version is lower than 6.0, the computer will mistake the 1.4 MB drive for an 800K drive.

1. Place the Macintosh II on the grounded workbench pad and put on your grounding wriststrap.
2. Remove the top cover, video card (and any other cards installed), and the drive mount.
3. Using an IC extractor, remove the four ROMs at the logic board locations shown in Figure 4.

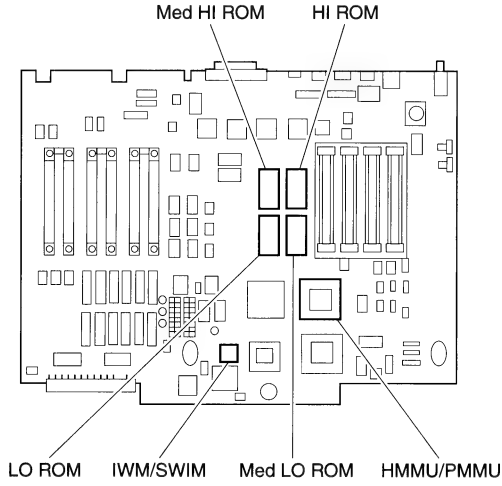


Figure 4 Macintosh II Logic Board

4. Using the following chart and Figure 4, install the four revised 512K ROMs. The notch at the end of each ROM should face the front of the logic board.

ROM	P/N
HI	661-0639
MED HI	661-0640
MED LO	661-0641
LO	661-0642

5. Using the IWM/SWIM extractor, remove the IWM chip from the logic board (see Figure 4).

6. Position the SWIM chip (see Figure 4) so that the beveled edge with the white dot faces the white dot on the logic board.
7. Align the pins in the socket and gently press straight down on the SWIM chip until it seats in the socket.
8. Install the 1.4 MB Apple SuperDrive onto the drive mount on drive 1 or drive 2.
9. Replace the drive mount, the video card (and any other cards that you removed), and the cover.
10. Place the 1.4 MB and 800K labels in the appropriate positions on the front of the Macintosh II.

PMMU Upgrade

1. Remove the Macintosh II cover and drive mount.
2. Locate the HMMU chip on the logic board (see Figure 4).
3. Using a small, flat-blade screwdriver, gently pry up the sides of the chip to remove the HMMU from the socket.
4. Position the PMMU so that the line on its surface points toward the speaker at the lower-right corner of the logic board.
5. Align the pins in the socket and gently press the PMMU into the socket.
6. Replace the Macintosh II drive mount and top cover.

The Macintosh IIfx computer can transfer data to and from SCSI devices much faster than earlier Macintosh computers. This increased data transfer rate has made it necessary to modify the termination characteristics of the SCSI interface. Three new parts are used to implement these SCSI termination changes:

- Apple SCSI Cable Terminator II
- Internal SCSI Termination Block
- Internal SCSI Filter

Apple SCSI Cable Terminator II

To provide proper termination, you must install a SCSI Cable Terminator II when an external SCSI device is attached to a Macintosh IIfx. Rules for using and installing the Terminator II are the same as those for the original SCSI terminator. The plastic on the Terminator II is black, whereas the plastic on the original terminator is blue.

Caution **Use only one Cable Terminator II on a SCSI daisy chain. Connecting more than one terminator can damage the Macintosh IIfx.**

Internal SCSI Termination Block

The termination block must be installed to provide internal SCSI termination for systems without an internal SCSI hard drive. Apple installs this termination block (and the internal SCSI filter) on all Macintosh IIfx systems shipped without internal SCSI drives (see Figure 5).

The termination block is located on the logic board's SCSI connector. You must remove the termination block when you add an internal SCSI drive to the system.

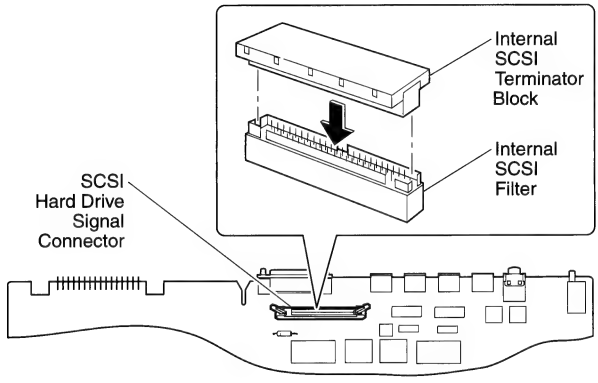


Figure 5 Macintosh IIfx Without Internal SCSI Drive

Internal SCSI Filter

The SCSI filter must be installed to provide the proper termination capacitance for third-party drives and for Apple internal drives shipped before 3/19/90. When you install a SCSI drive in a Macintosh IIfx computer that shipped without a SCSI drive, you must remove the SCSI filter from the Macintosh IIfx logic board and install the filter on the drive.

Some Macintosh IIfx computers and 4 MB expansion memory kits have defective DRAM chips from NEC. The defective NEC SIMMs, which have date code 9052 or lower, should be replaced. Locate the date code as shown in Figure 6.

Computers using these defective SIMMs can experience a variety of failures, including:

- Computer does not boot.
- Computer hangs on first application launch.
- Computer boots but loses video (memory related).
- Computer sounds error chords.
- Computer display exhibits ghosting.
- Computer displays an ID error and locks up.

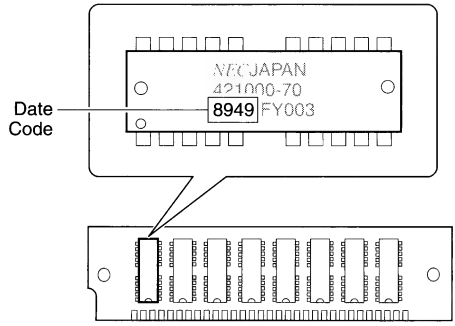


Figure 6 Location of Date Code on NEC SIMMs

Macintosh IIcx, IIci, and IIsi

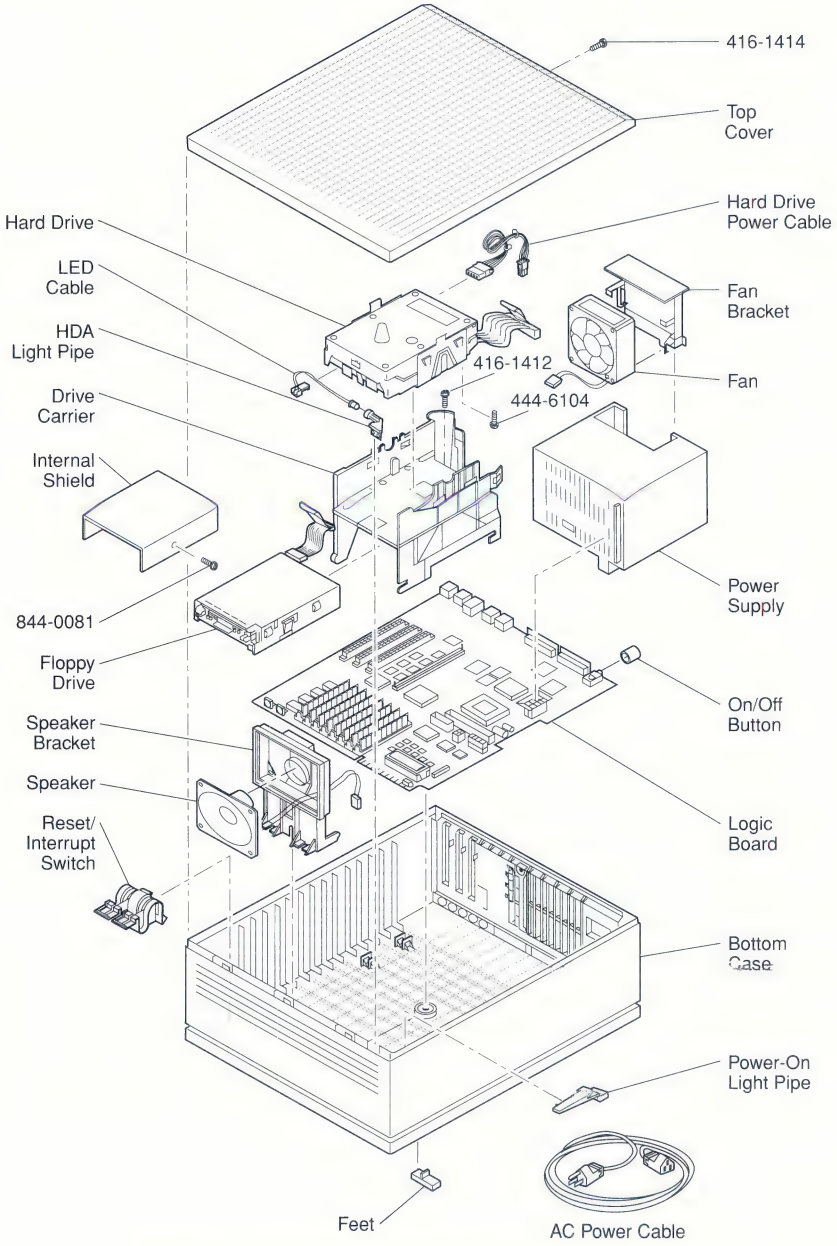


Figure 1 Macintosh IIcx and IIci Exploded View

Macintosh IIcx & IIci

Bottom case parts
- Cable, HDA LED (amber) 590-0506
- Light pipe, power-on 815-6032
- Light pipe, HDA 815-6036
- Rubber feet 865-0026

Cable, power, 110 VAC (smoke) 590-0380
Floppy drive, Apple SuperDrive 661-0474
- Cable, internal SuperDrive (yellow stripe) 590-0607
- Internal shield 805-0961
- Screw, SuperDrive shield/carrier to SuperDrive 844-0018

HDA, 40 MB, internal 3.5" SCSI 661-0464
HDA, 80 MB, internal 3.5" SCSI 661-0600
HDA, 80 MB, internal 3.5" SCSI with A/UX, v.1.1 661-0561
HDA, 80 MB, internal 3.5" SCSI with A/UX, v.2.0 661-0613
- Cable, HDA power (Mac IIcx) 590-0505
- Cable, HDA power (2 x 2 pin) 590-0512
- Cable, internal HDA (SCSI connector cable) 590-0609
- Drive carrier, HDA, 3.5" SCSI, internal 805-5078
- Drive mount 815-6030
- Screw, 6-32 x .250 (HDA to HDA bracket) 444-6104
- Screw, M 3.5 x .6 x 8 HDA bracket/bottom case) 416-1412

Lithium battery (w/o leads) 742-0011
- Battery holder cover 520-0344

Mouse, ADB 661-0479
On/off button 815-6033
Power supply with fan 661-0467
- Bracket, power supply fan 815-5071
- Power supply fan 982-0023

Reset/interrupt switch 815-6034
Speaker 630-5503
- Speaker bracket 815-6031

Top cover 810-6028
- Screw,cover 416-1414

Macintosh IIcx

Bottom case 630-5502
Logic board (w/o RAM; replaces 661-0459) 661-0537
- SIMM, 256K, 120 ns 661-0402
- SIMM, DIP, 256K, 120 ns 661-0494
- SIMM, 1 MB, 120 ns 661-0403
- SIMM, DIP, 1 MB, 120 ns 661-0410

Macintosh IIci only

Bottom case 630-5662
Cache card 661-1602
Logic board (w/o RAM) 661-0532
- SIMM, 256K x 4, 80 ns 661-0519
- SIMM, 1 MB, 80 ns 661-0520

Logic board, parity 661-0583
- SIMM, 1 MB x 9, 80 ns, parity 661-0546

Macintosh IIsi

Bottom case 630-5804
- Platinum foot 865-0024

Fan assembly 810-6030
Floppy drive, Apple SuperDrive 661-0474
- Cable, internal SuperDrive 591-0025
- SuperDrive carrier/shield 805-0961
- Screw, SuperDrive shield/carrier to SuperDrive 844-0018

HDA, 40 MB, 1", internal 3.5" SCSI 661-0614
HDA, 80 MB, 1", internal 3.5" SCSI 661-0624
- Cable, internal HDA (SCSI connector cable) 591-0026
- Cable, HDA power 591-0027
- HDA carrier 805-0980
- Screw, 6-32 x .250 (carrier to HDA) 444-6104

Logic board 661-1615
- Bracket, plastic, 030 adapter card 815-6246
- NuBus adapter card 661-0645
- Processor direct adapter card 661-0644
- SIMM, SOJ, 256K, 80 ns 661-0519
- SIMM, 512K, 80 ns, ... 661-0646
- SIMM, SOJ, 1 MB, 80 ns 661-0520
- SIMM, 2 MB, 80 ns 661-0643
- Thumbscrew, NuBus adapter card 450-0032

Microphone assembly 699-5071
Power supply 661-1616
Speaker/LED assembly 810-6031
Top cover 810-6034
Light pipe, power-on 815-6247

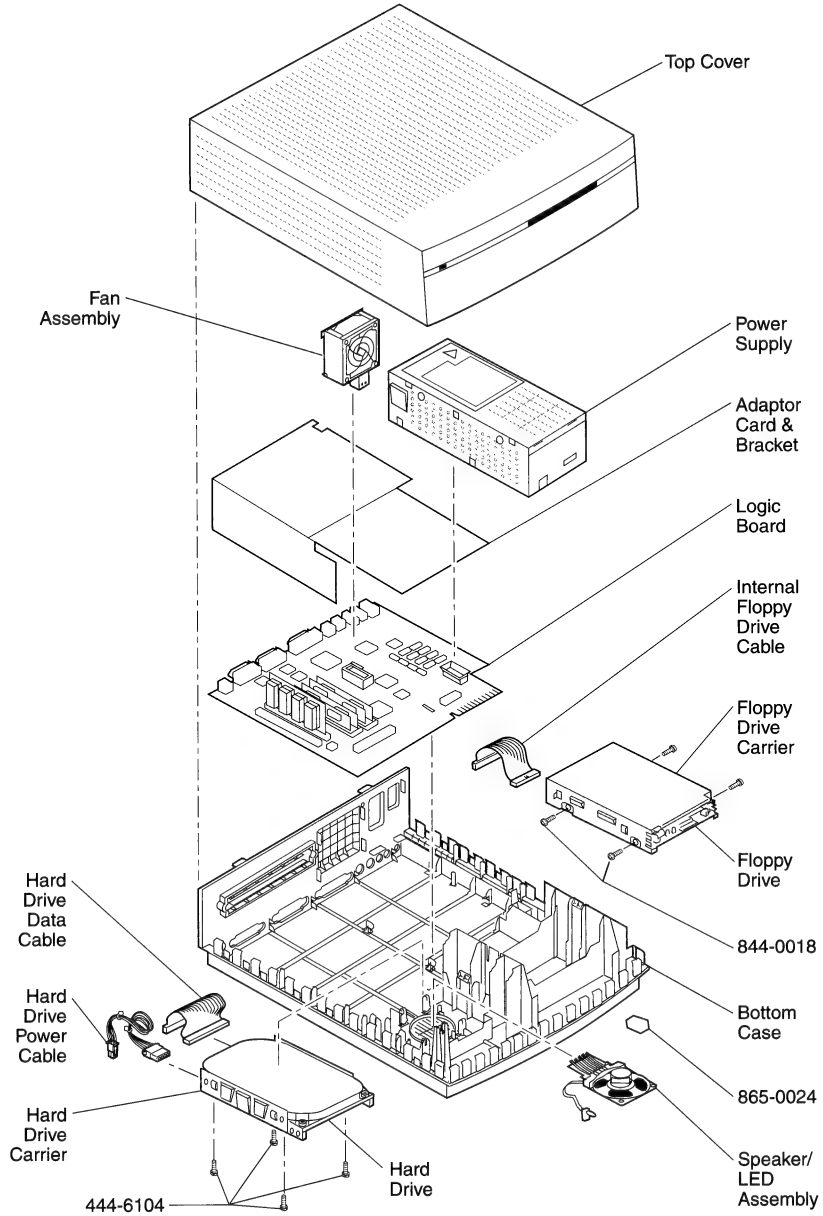


Figure 2 Macintosh IIsi Exploded View

Specifications—Macintosh IIcx

Processor	Motorola 68030 microprocessor; 15.6672 MHz; 32-bit internal data bus; 256-byte instruction and data caches; built-in paged memory management unit (PMMU) Coprocessor: Motorola 68882 floating-point unit (FPU); accepts optional coprocessor cards installed in NuBus expansion slots
Memory	RAM: 1 MB, expandable to 8 MB (120 ns or faster SIMMs) ROM: 256K
Disk Storage	Floppy drive: Internal 1.4 MB floppy drive Hard drive: Optional internal 40 or 80 MB hard drive
I/O Interfaces	ADB: Two ADB ports allow daisy-chaining of multiple peripheral devices Serial: Two RS-232/RS-422 serial ports; mini DIN-8 connectors Hard drive: DB-25 connector Floppy drive: One DB-19 serial port for connecting external floppy drives NuBus: Three internal slots support full 32-bit address and data buses Sound: Sound jack
Sound	Sound generator: Custom digital sound chip provides 8-bit stereo sampling at 44.1 KHz; four-voice, wavetable synthesis—capable of driving stereo headphones or other stereo equipment through the sound jack
Electrical	Line voltage: 100-240 VAC, automatically configured Frequency: 50-60 Hz Maximum power: 90 W (not including monitor power)
Physical	Height: 5.5 in. (14 cm) Width: 11.9 in. (30.2 cm) Depth: 14.4 in. (36.5 cm) Weight: 14 lb. (6.4 kg) with hard drive

Specifications—Macintosh IIci

Processor	Motorola 68030 microprocessor; 25 MHz; 32-bit internal data bus; burst mode RAM access; 256-byte instruction and data caches Coprocessor: Motorola 68882 floating-point unit (FPU)
Memory	RAM: 1 MB, expandable to 8 MB; 80 ns or faster SIMMs ROM: 256K Cache connector: 120-pin memory cache connector Parity support: Optional parity-generating chip and parity RAM convert the system to a parity system
Disk Storage	Floppy drive: 1.4 MB floppy drive Hard drive: Optional internal hard drive (many capacities)
I/O Interfaces	ADB: Two ADB ports allow daisy-chaining of multiple peripheral devices Serial: Two RS-232/RS-422 serial ports; mini DIN-8 connectors Floppy drive: One DB-19 serial port for connecting external floppy drives SCSI: 50-pin internal connector; DB-25 external connector NuBus: Three internal NuBus slots support full 32-bit address and data buses Video: One DB-15 video port for built-in video Sound: Stereo sound jack
Sound and Video	Sound generator: Custom digital sound chip provides 8-bit stereo sampling at 44.1 KHz; four-voice, wavetable synthesis—capable of driving stereo headphones or other stereo equipment through the sound jack Video: Supports 640 by 480 pixel screens at up to 256 colors or shades of gray (up to 8 bits per pixel); supports 640 by 870 pixel screens at up to 16 shades of gray
Electrical	Line voltage: 100–240 VAC, automatically configured Frequency: 50–60 Hz Maximum power: 90 W (not including monitor power)
Physical	Height: 55 in. (14 cm) Width: 11.9 in. (30.2 cm) Depth: 14.4 in. (36.5 cm) Weight: 14 lb. (6.4 kg) with internal hard drive

Specifications—Macintosh IIsi

Processor	Motorola 68030 microprocessor; 20 MHz; 32-bit internal data bus; 256-byte instruction and data caches; burst-mode RAM access; built-in memory management unit (MMU) Coprocessor (on optional adapter card): Motorola 68882 floating-point unit (FPU)
Memory	RAM: 2 MB, expandable to 17 MB ROM: 512K PRAM: 256 bytes
Disk Storage	Floppy drive: Internal 1.4 MB floppy drive Hard drive: Internal 40 MB hard drive; optional internal 80 MB hard drive
I/O Interfaces	Serial: Two RS-232/RS-422/AppleTalk serial ports; mini DIN-8 connectors SCSI: One external SCSI port; DB-25 connector Slot expansion: One slot for either a NuBus or an 030 direct slot card; 15 W max. power available (+5 V, 2A; +12 V, 0.175 A; -12 V, 0.15 A)
I/O Devices	Keyboard: Apple Keyboard, Apple Keyboard II, or Apple Extended Keyboard connected through ADB ports; mini DIN-4 connectors Mouse: ADB mouse; mini DIN-4 connector
Sound	Output impedance of 8-600 ohms; short-circuit protected; sound-out jack disables internal speaker; four-voice, wavetable synthesis and stereo sampling generator
Electrical	Line voltage: 100–240 VAC, automatically configured Frequency: 50–60 Hz, single phase Maximum power: 100 W (not including monitor)
Physical	Height: 4 in. (10 cm) Width: 12.4 in. (31 cm) Depth: 14.9 in. (37.2 cm) Weight: 10 lb. (4.5 kg); weight varies with configuration of RAM, floppy drives, hard drives, and expansion cards

Symptom/Cure Chart

System Problems	Solutions
Does not power on—screen is black, fan is not running, and LED is not lit	1. Check cables. 2. Plug monitor directly into wall socket, and verify that monitor has power. 3. Replace power cable. 4. Check batteries. Voltage should be above 2.8. 5. Replace power supply. 6. Replace logic board. Move customer's SIMMs to new logic board.
System intermittently crashes or locks up	1. Make sure system software is correct version. 2. Make sure you have known-good software. 3. Replace logic board. Move customer's SIMMs to new logic board. 4. Replace SIMMs. 5. Replace power supply. 6. If system has Macintosh IIci Cache Card with a serial number beginning with "CF," remove and return card to Apple. See Apple Service Programs manual in *Service Source*.
Clicking, chirping, or thumping sound	1. Replace power supply. 2. Disconnect hard drive. Replace drive if noise disappears. 3. Replace logic board. Move customer's SIMMs to new logic board.
System shuts down intermittently	1. Make sure air vents on back side and top of case are not obstructed. Thermal protection circuitry may shut down system. After 30 to 40 minutes, system should be OK. 2. Replace power cable. 3. Replace power supply. 4. Replace logic board. Move customer's SIMMs to new logic board.
System intermittently won't power on	1. Check cables. 2. Plug monitor directly into wall socket and verify that monitor has power. 3. Try known-good keyboard and ADB cable. 4. Replace power cable. 5. Check batteries. Voltage should be above 2.8. 6. Unplug power cord from system for 5-10 minutes. Replace power cord and switch on system. If system starts normally, replace power supply. 7. Replace logic board. Move customer's SIMMs to new logic board.
System seems to boot, then message "Finder is old version" displays	1. Clear parameter RAM. Hold down <Command> <Option> <P> <R> keys and reboot system. You will hear normal startup chords and about two seconds later you will hear another chord. This means parameter RAM has been cleared. 2. Replace logic board. Move customer's SIMMs to new logic board.
System restarts itself (Macintosh IIci and IIsi)	– Set the locking power switch on the rear of the computer to the unlocked (horizontal) position.

Video Problems	Solutions
Screen is dark, no audio, but fan is running and LED is lit	1. Replace video cable. 2. Replace monitor. 3. Move video card to a different slot. 4. Replace video card. 5. Remove NuBus cards. 6. Remove external peripherals. 7. Replace RAM SIMMs. 8. If computer is a Macintosh IIsi with a ROM SIMM, replace ROM SIMM. 9. Replace logic board. Move customer's SIMMs to new logic board. 10. Replace power supply.
Screen is dark, audio and drive operate, fan is running, and LED is lit	1. Adjust brightness on monitor. 2. Replace monitor. 3. Replace video cable. 4. Move video card to a different slot. 5. Replace video card. 6. Replace RAM SIMMs. 7. If computer is a Macintosh IIsi with a ROM SIMM, replace ROM SIMM. 8. Replace logic board. Move customer's SIMMs to new logic board. 9. Replace power supply.
Partial or whole screen is bright and audio is present, but no video information is visible	1. Replace video cable. 2. Replace monitor. 3. Move video card to a different slot. 4. Replace video card. 5. Make sure ROM jumper is on logic board. 6. Replace logic board. Move customer's SIMMs to new logic board.
Screen is completely dark, fan is not running, and LED is not lit	1. Plug monitor directly into wall socket and verify that monitor has power. 2. Remove NuBus cards. 3. Remove peripheral devices. 4. Replace power supply. 5. Replace logic board. Move customer's SIMMs to new logic board.
Black and white video only	– Change monitor CDEV in Control Panel for additional shades of gray or color. Note: Macintosh IIci and IIsi computers with 1 MB of RAM default to black-and-white video. You can allocate additional memory to video on computers with 1 MB RAM, but this allocation leaves little free RAM for other applications.

SCSI Problems	Solutions
Internal hard drive won't operate	1. Replace SCSI cable connector. 2. Replace SCSI power connector. 3. Replace hard drive. 4. Replace logic board. Move customer's SIMMs to new logic board.

Works with internal or external SCSI device but not both	1. Check that SCSI device switch setting on external device is unique. 2. Replace terminator on external device. 3. Verify that terminator is installed on internal SCSI drive. 4. Replace SCSI device select cable.

Floppy Drive Problems	**Solutions**
Audio and video are present, but internal floppy drive doesn't operate	1. Replace bad disk. 2. Verify that all external SCSI devices are disconnected. 3. Replace floppy drive cable. 4. Replace floppy drive. 5. Replace logic board. Move customer's SIMMs to new logic board. 6. Replace power supply.
Disk ejects; display shows icon with blinking "X"	1. Replace disk with known-good system disk. 2. Replace floppy drive cable. 3. Replace floppy drive. 4. Replace logic board. Move customer's SIMMs to new logic board.
Drive won't eject disk	1. Switch power off and hold mouse button down while switching power back on. 2. Eject disk manually by pushing opened paper clip into hole beside drive slot. 3. Replace drive.
Drive attempts to eject disk but can't	1. Push disk completely in. 2. Eject disk manually by pushing opened paper clip into hole beside drive slot. 3. Replace drive.
Internal drive runs continuously	1. Replace bad disk. 2. Replace floppy drive cable. 3. Replace floppy drive. 4. Replace logic board. Move customer's SIMMs to new logic board.

Peripheral Problems	**Solutions**
No response to any key on the keyboard	1. Check keyboard connection to ADB port. 2. Replace keyboard cable. 3. Replace keyboard. 4. Replace logic board. Move customer's SIMMs to new logic board.
Cursor doesn't move	1. Reboot computer. 2. Check mouse connection. 3. If mouse was connected to keyboard, connect mouse to rear ADB port. If mouse works, replace keyboard. If mouse does not work in any ADB port, replace mouse. 4. Replace logic board. Move customer's SIMMs to new logic board.

Cursor moves, but clicking the mouse button has no effect	1. Replace mouse. 2. Replace logic board. Move customer's SIMMs to new logic board.
Cannot double-click to open an application, disk, or server	1. Remove any extra system files from hard drive. 2. Clear parameter RAM. Hold down <Shift> <Option> <Command> keys and select **Control Panel** from Apple menu. Reset mouse controls. 3. If mouse was connected to keyboard, connect mouse to rear ADB port. If mouse works, replace keyboard. If mouse does not work in any ADB port, replace mouse. 4. Replace logic board. Move customer's SIMMs to new logic board.
Known-good ImageWriter or ImageWriter II won't print	1. Make sure system software is correct version. 2. Make sure Chooser and control panel settings are correct. 3. Check DIP switch settings. 4. Replace printer interface cable. 5. Replace logic board. Move customer's SIMMs to new logic board.
Known-good LaserWriter won't print	1. Make sure system software is correct version. 2. Make sure Chooser and Control Panel are set correctly. 3. Refer to Networks manual in *Service Source*.

Miscellaneous Problems	**Solutions**
No sound from speaker	1. Verify that volume setting in the Control Panel is set to 1 or above. 2. Replace speaker. 3. Replace logic board. Move customer's SIMMs to new logic board.
Clock not running	1. Replace battery. 2. Replace logic board. Move customer's SIMMs to new logic board.
MacTest and *AppleCAT* crash on Macintosh IIci	– Remove the Macintosh IIci Cache Card and rerun the diagnostic.

The Macintosh IIcx computer requires 120 ns (or faster) SIMMs. The 150 ns SIMMs will cause serious timing problems. All SIMMs in each bank must be the same size.

Macintosh IIcx Memory Configurations

Total RAM	Bank A	Bank B
1 MB	Four 256K SIMMs	Empty
2 MB	Four 256K SIMMs	Four 256K SIMMs
4 MB	Four 1 MB SIMMs	Empty
5 MB	Four 1 MB SIMMs	Four 256K SIMMs
8 MB	Four 1 MB SIMMs	Four 1 MB SIMMs

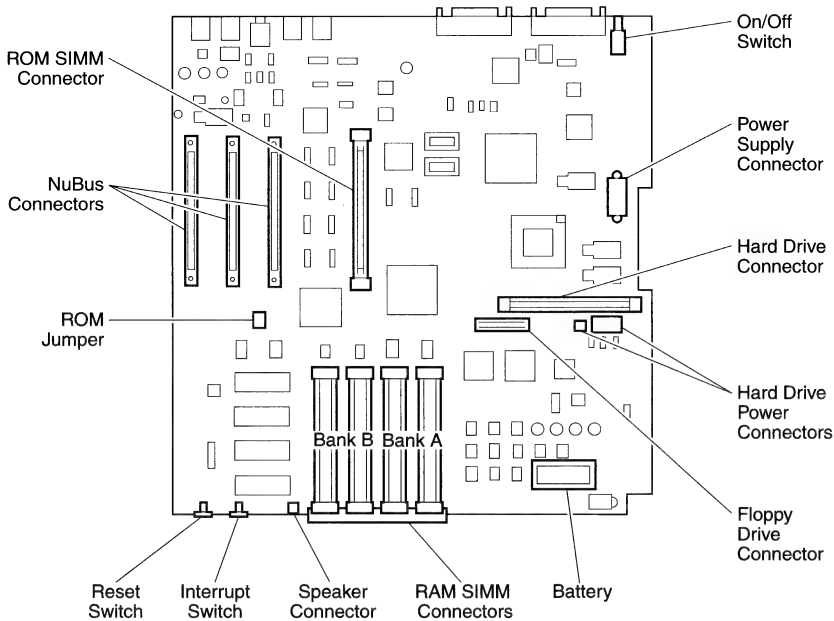


Figure 3 Macintosh IIcx Logic Board

The Macintosh IIci computer requires 80 ns fast page mode SIMMs. Slower SIMMs will cause serious timing problems. All SIMMs in a bank must be the same size. SIMMs must be installed in bank A if the computer uses built-in video mode. To upgrade a parity system, you must use 80 ns, 1 MB x 9-bit parity SIMMs or the parity function will be disabled.

Memory Configurations

Total RAM	Bank A	Bank B
1 MB	Four 256K SIMMs Empty	Empty Four 256K SIMMs
2 MB	Four 256K SIMMs	Four 256K SIMMs
4 MB	Four 1 MB SIMMs Empty	Empty Four 1 MB SIMMs
5 MB	Four 1 MB SIMMs Four 256K SIMMs	Four 256K SIMMs Four 1 MB SIMMs
8 MB	Four 1 MB SIMMs	Four 1 MB SIMMs
4 MB Parity	Four 1 MB parity SIMMs Empty	Empty Four 1 MB SIMMs
8 MB Parity	Four 1 MB SIMMs	Four 1 MB SIMMs

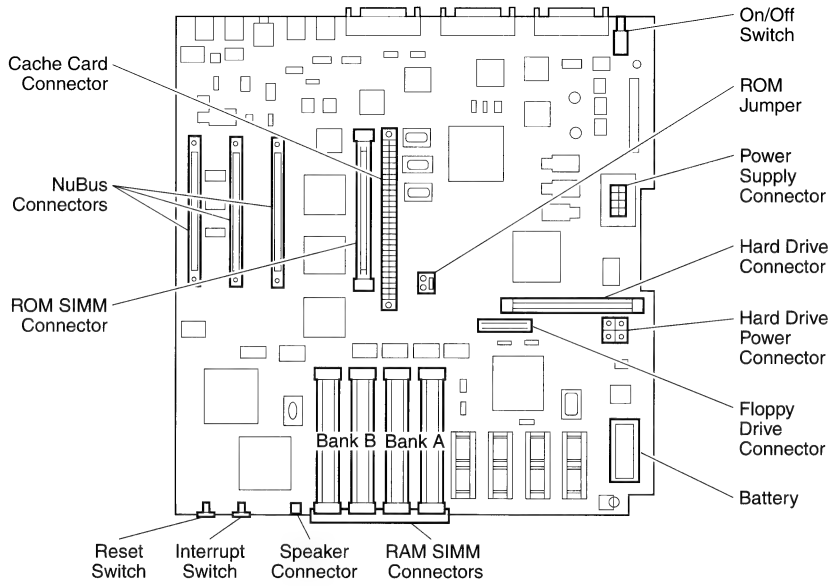


Figure 4 Macintosh IIci Logic Board

The Macintosh IIsi computer requires 100 ns (or faster) SIMMs. Slower SIMMs (120 ns, for example) will cause serious timing problems. All SIMMs must be the same size.

Macintosh IIsi Memory Configurations

Total RAM	Bank A	Bank B
1 MB	1 MB RAM (soldered)	Empty
2 MB	1 MB RAM (soldered)	Four 256K SIMMs
5 MB	1 MB RAM (soldered)	Four 1 MB SIMMs

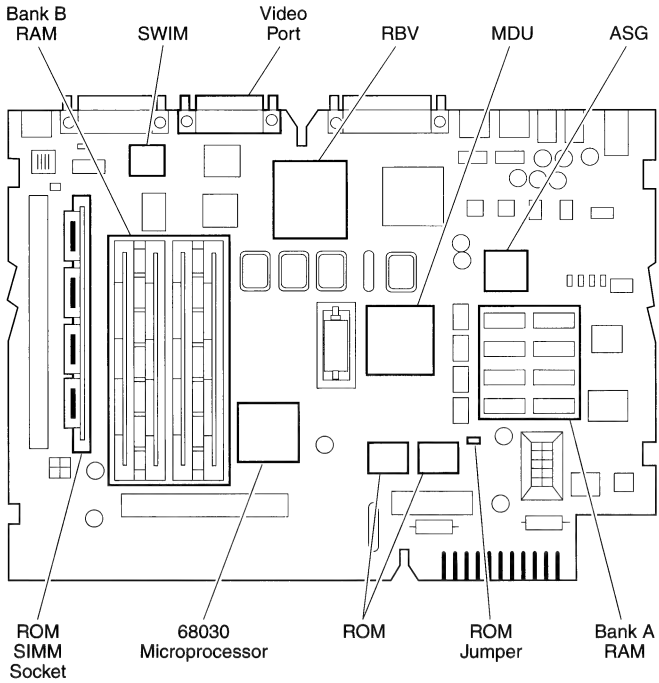


Figure 5 Macintosh IIsi Logic Board

Macintosh IIvx, IIvi, and Performa 600

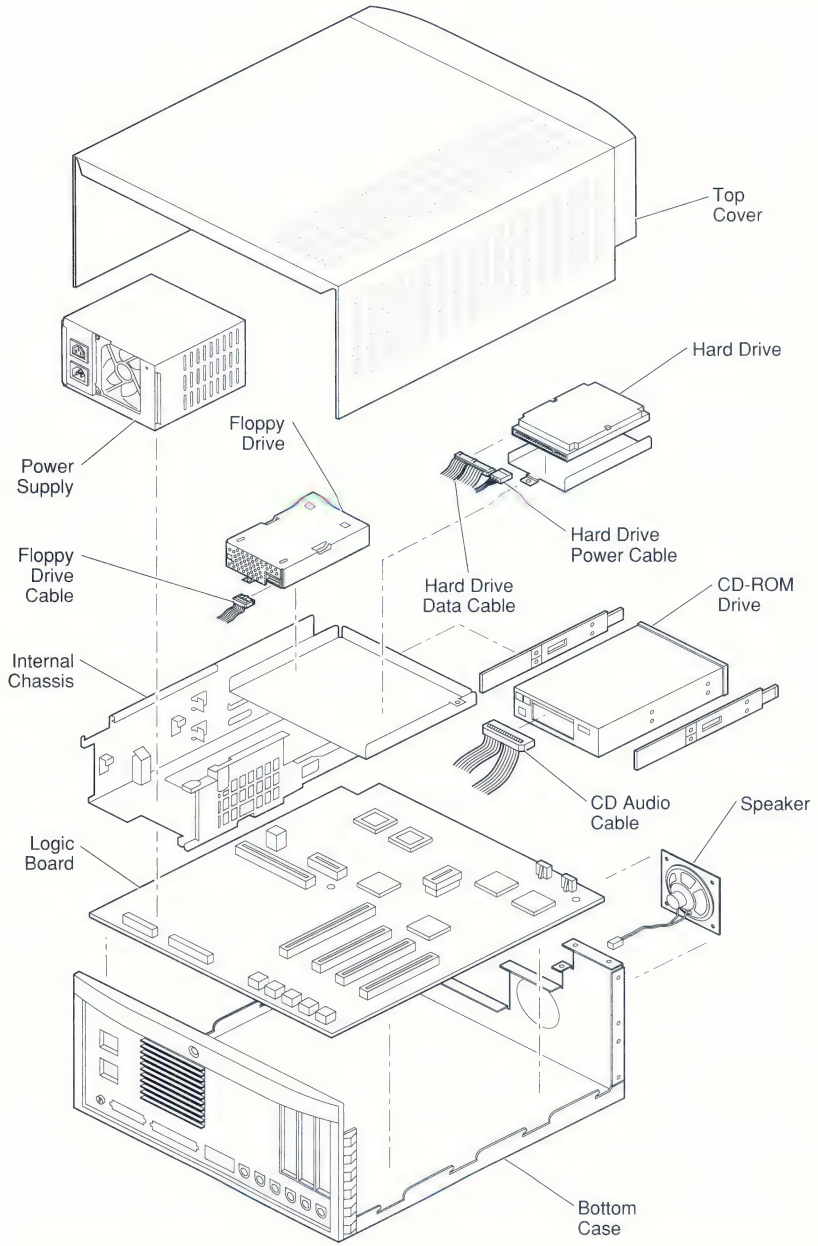


Figure 1 Macintosh IIvx, IIvi, and Performa 600 Exploded View

Battery, lithium 742-0011
Battery holder cover 520-0344
Bottom case 922-0057
Bottom case EMI clip 922-0101
Feet 865-0024
NuBus cap 810-6035
PCB snap-in hook 922-0097
Cable, AC power (smoke) 590-0380
Cables, internal
Cable, CD audio 922-0052
Cable, floppy drive 922-0112
Cable, HDA/CD-ROM power 922-0051
Cable, SCSI data 922-0053
CD-ROM drive, Apple CD-300 661-1646
CD-ROM drive rails 922-0067
CD-ROM EMI clip 922-0115
Screws,CD-ROM rails 416-1305
Chassis 922-0058
Cover 922-0056
Bezel, blank 922-0060
Bezel, slotted 922-0061
Front panel, molded 922-0059
Name plate, Macintosh IIvx 922-0063
Name plate, Macintosh IIvi 922-0065
Name plate, Performa 600 922-0064
Screw, front panel (3.5 x 1.57 x 7) 922-0117
Screw, front panel (3.5 x 1.47 x 30) 922-0118
Floppy drive, Apple SuperDrive 661-0474
Floppy drive carrier 805-5050
Screw, SuperDrive to carrier 460-3400
Hard drive carrier 922-0066
HDA, 80 MB, 1" high, internal 3.5" SCSI (IIvx/IIvi) 661-0624
HDA, 160 MB, internal 3.5" SCSI (Performa 600 only) 661-1647
HDA, 230 MB, internal 3.5" SCSI (IIvx/IIvi) 661-1637
HDA, 400 MB, internal 3.5" SCSI (IIvx/IIvi) 661-1636
Keyboard, Apple 661-0383
Light pipe, power on 815-6272
Logic board, Macintosh IIvx 661-0759
Screw, logic board 922-0119
Logic board, Macintosh IIvi 661-0760
Logic board, Performa 600 661-0761
Microphone assembly 669-5103
Mouse, ADB 661-0479

Specifications

Processor	Motorola 68030; built-in memory management unit (MMU); 32-MHz (Macintosh IIvx, Performa 600); 16 MHz (Macintosh IIvi) Coprocessor (Macintosh IIvx only): Motorola 68882 floating-point unit (FPU); 32 MHz Cache (Macintosh IIvx only): 32K RAM cache soldered on logic board Addressing: 32-bit internal registers, address bus, and data bus
Memory	RAM: 4, 5, or 8 MB, expandable to 68 MB ROM: 1 MB PRAM: 256 bytes VRAM: 512K, upgradeable to 1 MB 512K VRAM supports the following video modes: 512 by 384 pixel screens with 2, 4, 8, and 16 bits/pixel 640 by 480 pixel screens with 2, 4, and 8 bits/pixel 1 MB VRAM supports the following video modes: 512 by 384 pixel screens with 2, 4, 8, and 16 bits/pixel 640 by 480 pixel screens with 2, 4, 8, and 16 bits/pixel
Disk Storage	Floppy drive: 1.4 MB Apple SuperDrive Hard drive: 80–400 MB CD-ROM drive: Optional CD-ROM 300
I/O Interfaces	ADB: Two ADB ports Serial: Two RS-232/RS-422 ports SCSI: 50-pin internal connector; DB-25 external connector NuBus: Three NuBus internal slots supporting full 32-bit address and data buses One accelerator slot Sound: One sound output (stereo for CDs) Video: DB-15 video port for built-in video
I/O Devices	Keyboard: Standard or extended keyboard; mini DIN-4 (ADB) connector; draws 25-80 mA Mouse: ADB mouse; draws up to 80 mA Microphone: Electret omnidirectional microphone; 4 mV peak-to-peak output voltage at normal speaking Maximum power draw for all ADB devices: 500 mA
Sound and Video	Sound: Custom digital Apple sound chip (ASC) Video: Supports Macintosh 12" Monochrome Display, Macintosh 12" RGB Display, AppleColor High-Resolution RGB, and Macintosh Color Display; NuBus video cards allow computer to support other non-Apple VGA, NTSC, and PAL monitors
Electrical	Line voltage: 100–240 VAC, automatically configured Frequency: 50–60 Hz 112 W, maximum power, not including monitor power

Symptom/Cure Chart

System Problems	Solutions
One-tone error chord sounds during startup sequence	1. Disconnect SCSI hard drive power and data cable and restart computer. If startup sequence is normal, run *Macintosh Hard Disk Test* and replace hard drive if necessary. 2. Disconnect floppy drive cable and restart computer. If startup sequence is normal, replace floppy drive. 3. Replace logic board. Move customer's SIMMs to new logic board.
Two-tone error chord sounds during startup sequence	1. Replace DRAM SIMMs. 2. Replace logic board. Move customer's SIMMs to new logic board. 3. Perform SIMM verification on replacement logic board.
Doesn't power on—screen is black, fan is not running, and LED is not lit	1. Check cables. 2. Plug monitor directly into wall socket. Verify that monitor has power. 3. Replace power cable. 4. Check batteries. Voltage should be above 2.8. 5. Replace power supply. 6. Replace logic board. Move customer's SIMMs to new logic board.
System intermittently crashes or locks up	1. Make sure system software is correct version. 2. Make sure you are using known-good software. 3. Replace SIMMs. 4. Replace power supply. 5. Replace logic board. Move customer's SIMMs to new logic board.
Clicking, chirping, or thumping sound	1. Replace power supply. 2. Disconnect hard drive. Replace drive if noise disappears. 3. Replace logic board. Move customer's SIMMs to new logic board.
System shuts down intermittently	1. Make sure air vents on back side and top of main unit are not obstructed. Thermal protection circuitry may shut down computer. After 30 to 40 minutes, computer should be OK. 2. Replace power cable. 3. Replace power supply. 4. Replace logic board. Move customer's SIMMs to new logic board.
System intermittently doesn't power on	1. Check cables. 2. Plug monitor directly to wall socket and verify that monitor has power. 3. Swap keyboard and ADB cable. 4. Replace power cable. 5. Check batteries. Voltage should be above 2.8. 6. Unplug power cable from system for 5 to 10 minutes. Replace power cable and switch on computer. If computer starts normally, replace power supply. 7. Replace logic board. Move customer's SIMMs to new logic board.

System seems to boot, then message "Finder is old version" displays	1. Clear parameter RAM. Hold down <Shift> <Option> <P> <R> keys during startup but before "Welcome to Macintosh" message appears. 2. Replace logic board. Move customer's SIMMs to new logic board.
Won't start up without a monitor attached	– Verify Chooser and control panel settings are correct.

Video Problems	**Solutions**
Screen is dark, audio and at least one drive operate, fan is running, and LED is lit	1. Adjust brightness on monitor. 2. Replace video cable. 3. Replace monitor. 4. Replace VRAM SIMMs. 5. Replace logic board. Move customer's SIMMs to new logic board.
Screen is dark, audio and drive don't operate, fan is running, and LED is lit	1. Remove peripherals. 2. Remove NuBus cards. 3. Replace DRAM SIMMs. 4. Replace VRAM SIMMs. 5. Replace power supply. 6. Replace logic board. Move customer's SIMMs to new logic board.
Partial or whole screen is bright and audio is present, but no video information is visible	1. Replace video cable. 2. Replace monitor. 3. Replace VRAM SIMMs. 4. Replace logic board. Move customer's SIMMs to new logic board.
Screen is completely dark, fan is not running, and LED is not lit	1. Verify that external power cables are properly connected. 2. Remove peripherals. 3. Remove NuBus cards and switch on power. (Combined NuBus cards should not draw more than 45 W.) 4. Remove accelerator card. 5. Replace power supply. 6. Replace logic board. Move customer's SIMMs to new logic board.

Hard Drive Problems	**Solutions**
Internal hard drive runs continuously	1. Replace SCSI data cable. 2. Replace hard drive. 3. Replace logic board. Move customer's SIMMs to new logic board.
Internal hard drive doesn't operate	1. Replace SCSI data cable. 2. Replace SCSI power cable. 3. Replace hard drive. 4. Replace logic board. Move customer's SIMMs to new logic board.

Apple SuperDrive Problems	Solutions
Audio and video are present, but internal floppy drive doesn't operate	1. Replace internal floppy drive cable. 2. Replace internal floppy drive. 3. Replace logic board. Move customer's SIMMs to new logic board.
Floppy disk ejects; display shows icon with blinking "X"	1. Replace disk with known-good system disk. 2. Replace internal floppy drive cable. 3. Replace internal floppy drive. 4. Replace logic board. Move customer's SIMMs to new logic board.
Floppy drive won't eject disk	1. Switch off computer and hold mouse button down while switching computer on. 2. Eject disk manually. 3. Replace floppy drive cable. 4. Replace floppy drive.
Floppy drive attempts to eject disk, but can't	1. Push floppy disk completely in. 2. Eject floppy disk manually. 3. Replace floppy drive.

CD-ROM Drive Problems	Solutions
CD-ROM drive doesn't accept a compact disc	1. Exchange disc. 2. Replace CD-ROM drive.
Macintosh doesn't display CD-ROM drive icon	1. Verify that CD-ROM extension is in System Folder. 2. Replace SCSI data cable. 3. Replace CD-ROM drive. 4. Replace power supply.

Peripheral Problems	Solutions
Computer works with internal or external SCSI device, but not with both	1. Verify that all SCSI select switch settings are unique. 2. Verify that hard drive is terminated but optional CD-ROM is not terminated. 3. Replace terminator on external SCSI device. 4. Replace SCSI select cable on external SCSI device.
No response to any key on the keyboard	1. Check keyboard connection to ADB port. 2. Replace keyboard cable. 3. Replace keyboard. 4. Replace logic board. Move customer's SIMMs to new logic board.

Cursor doesn't move	1. Reboot computer. 2. Check mouse connection. 3. If mouse was connected to keyboard, connect mouse to rear ADB port. If mouse works, replace keyboard. If mouse does not work in any ADB port, replace mouse. 4. Replace logic board. Move customer's SIMMs to new logic board.
Cursor moves, but clicking mouse button has no effect	1. Replace mouse. 2. Replace logic board. Move customer's SIMMs to new logic board.
Cannot double-click to open an application, disk, or server	1. Remove extra system files from hard drive. 2. Clear parameter RAM. Hold down <Shift> <Option> <P> <R> keys during startup but before "Welcome to Macintosh" message appears. 3. If mouse was connected to keyboard, connect mouse to rear ADB port. If mouse works, replace keyboard. If mouse does not work in any ADB port, replace mouse. 4. Replace logic board. Move customer's SIMMs to new logic board.
Known-good serial printer won't print	1. Make sure system software is correct version. 2. Make sure Chooser settings are correct. 3. Replace printer interface cable. 4. Replace logic board. Move customer's SIMMs to new logic board.
Known-good printer on Apple Talk network doesn't print	1. Make sure system software is correct version. 2. Make sure Chooser settings are correct. 3. Refer to *Networking and Communications Service Guide.*

Miscellaneous Problems	**Solutions**
No sound from speaker	1. Check speaker volume setting in the Sound control panel. 2. Replace speaker. 3. Replace logic board. Move customer's SIMMs to new logic board.
Clock doesn't run	1. Replace battery. 2. Replace logic board. Move customer's SIMMs to new logic board.

The Macintosh IIvx, IIvi, and Performa 600 computers require 80 ns fast page mode SIMMs. Slower SIMMs will cause serious timing problems. All four SIMM sockets must be filled and all SIMMs must be the same capacity and speed. You can use 256K, 1 MB, 2 MB, 4 MB, or 16 MB SIMMs. The list below shows the memory configurations for Macintosh IIvx, IIvi, and Performa 600 computers.

Macintosh IIvx/IIvi/Performa 600 Memory Configurations

Total RAM	Soldered RAM	SIMMs
4 MB	4 MB	Empty
5 MB	4 MB	Four 256K SIMMs
8 MB	4 MB	Four 1 MB SIMMs
12 MB	4 MB	Four 2 MB SIMMs
20 MB	4 MB	Four 4 MB SIMMs
68 MB	4 MB	Four 16 MB SIMMs

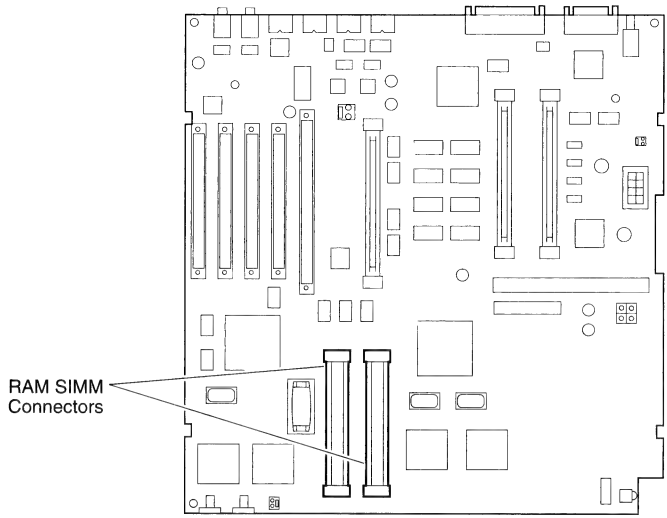
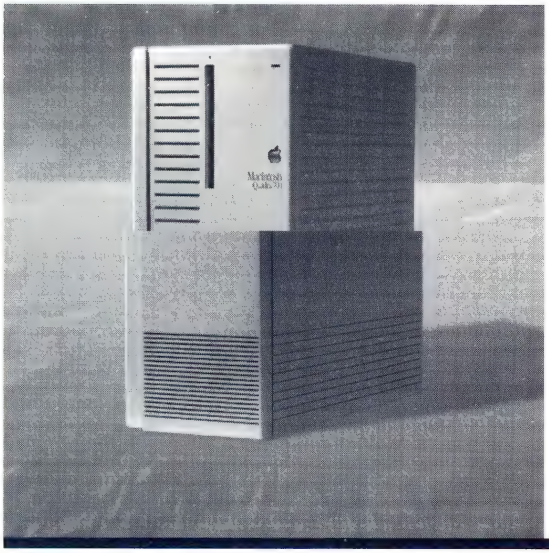
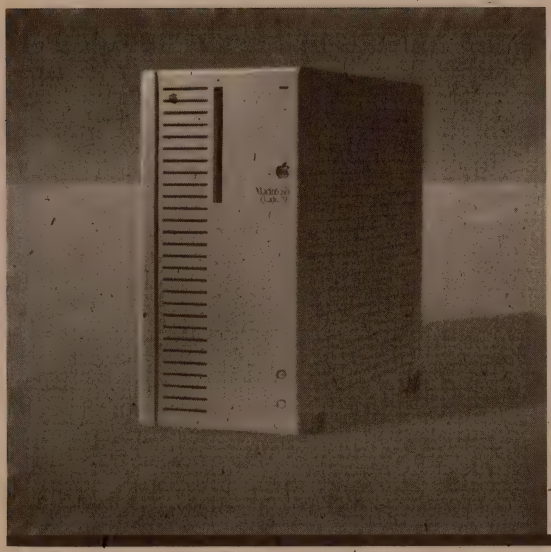


Figure 2 Macintosh IIvx/IIvi/Performa 600 Logic Board

Macintosh Quadra Computers



Macintosh Quadra 700



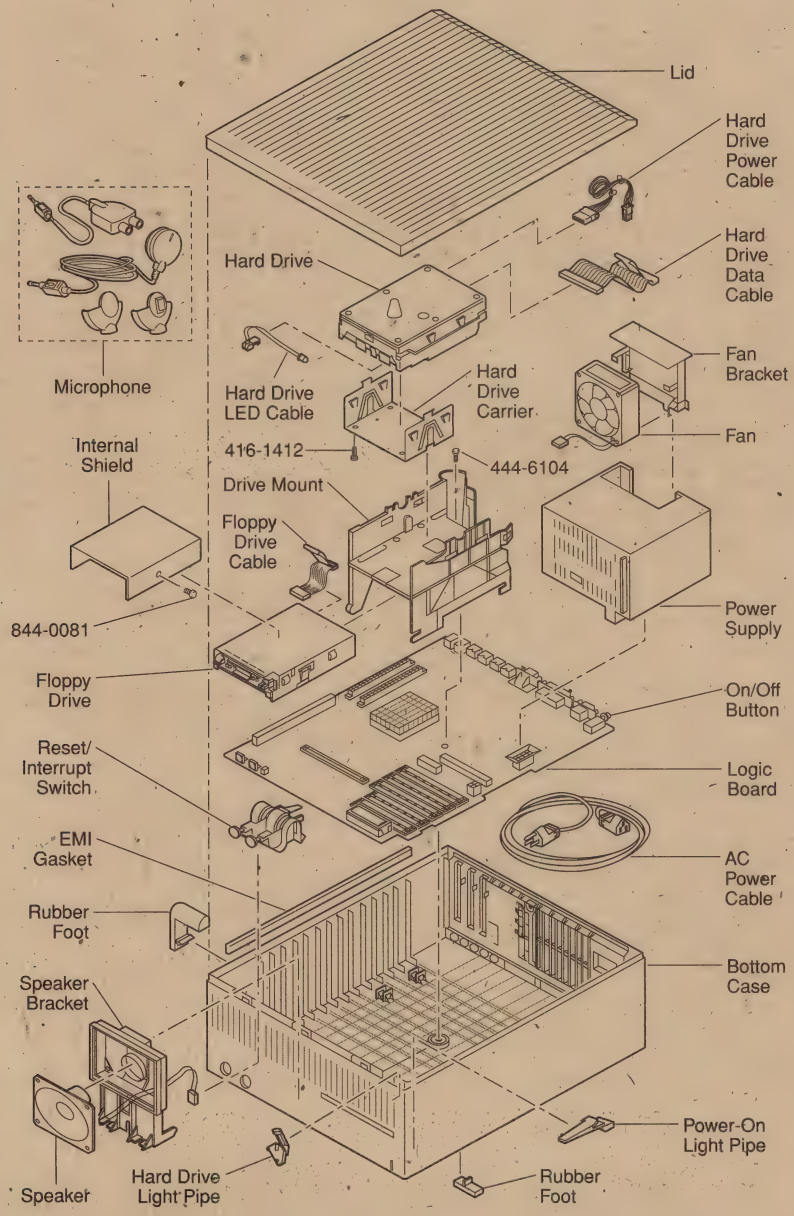


Figure 1 Macintosh Quadra 700 Exploded View

Bottom case 630-5992
EMI gasket 875-0110
HDA light pipe 815-6271
Light pipe, power-on 815-6272
On/off button 815-6033
Rubber feet, bottom 865-0026
Rubber foot, side 865-0800
Cable, AC power, 110 V (smoke) 590-0380
Carrier, HDA, internal 3.5", SCSI 805-5078
Cover, top 810-6038
Drive mount 810-6040
Floppy drive, 1.4 MB, Apple SuperDrive (internal) 661-0474
Cable, internal floppy drive (yellow stripe) 590-0607
Screw, socket, Phillips (1.4 MB mechanism) 844-0018
Service packaging, 800K/Apple SuperDrive 602-0210
Shield, internal (1.4 MB mechanism) 805-0961
HDA, internal 3.5" SCSI, 80 MB 661-0600
HDA, internal 3.5" SCSI, 160 MB 661-1641
HDA, internal 3.5" SCSI, 230 MB 661-1641
HDA, internal 3.5" SCSI, 400 MB 661-1636
Cable, HDA LED (amber) 590-0506
Cable, HDA LED (fits 1-inch-height drives) 590-0527
Cable, HDA LED (400 MB HDA) 590-0248
Cable, internal HDA power (2 x 2 pin) 590-0512
Cable, internal HDA, SCSI 590-0609
Screw, 6-32 x .25 (HDA to HDA bracket) 444-6104
Service pkg., HDA, 3.5", half-height & 1-inch-height, w/carrier 602-0282
Lithium battery (w/o leads) 742-0111
Battery holder cover 520-0344
Logic board 661-0666
DRAM SIMM, 1 MB, SOJ, 80 ns 661-0520
DRAM SIMM, 1 MB, SOJ, 80 ns 661-0719
VRAM SIMM, 256K, 100 ns 661-0609
VRAM SIMM, 256K, 80 ns 661-0722
Microphone assembly 699-5071
Power supply with fan 661-0467
Bracket, power supply fan 815-5071
Power supply fan 982-0023
Reset/interrupt switch 815-6270
Speaker, 8 ohms 630-5999
Speaker bracket 815-6031

Specifications

Processor	Motorola 68040 microprocessor; 25 MHz; built-in paged memory management unit (PMMU), floating-point unit (FPU), and 8K memory cache Addressing: 32-bit registers; 32-bit address/data bus
Memory	DRAM: 4 MB, expandable to 20 MB; 80 ns or faster SIMMs ROM: 1 MB soldered on logic board; ROM SIMM socket available PRAM: 256 bytes VRAM: 512K, expandable to 2 MB; 100 ns or faster VRAM SIMMS Clock/calendar: CMOS custom chip with long-life lithium battery
Disk Storage	Floppy drive: 1.4 MB floppy drive Hard drive: Internal 3.5" hard drive (many capacities)
I/O Interfaces	ADB: Two ADB ports for keyboard, mouse, and low-speed input devices; mini DIN-4 connectors Serial: Two RS-422 (RS-232-compatible) serial ports; 230.4 Kbaud max.; mini DIN-8 connectors SCSI: One SCSI port; DB-25 connector NuBus: Two NuBus slots; 96-pin Euro-DIN connectors Video: One DA-15 video port for built-in video Ethernet: Built-in Ethernet port; AAUI-15 connector Expansion: One 68040 processor-direct slot (PDS); 140-pin connector Sound: One stereo sound input port; one stereo sound output port
I/O Devices	Keyboard: Apple Keyboard, Apple Extended Keyboard, Apple Keyboard II, or Apple Extended Keyboard II Mouse: ADB mouse; mini DIN-4 connector
Sound and Video	Sound generator: Enhanced Apple sound chip (EASC), including four-voice, wavetable synthesis and stereo sampling generator capable of driving stereo mini phone jack headphones or other stereo equipment Video: Built-in VRAM supports all Apple monitors; six VRAM expansion slots (three banks); NuBus expansion slots support multiple external color and monochrome monitors
Electrical	Line voltage: 100–240 VAC Frequency: 50–60 Hz, single phase Maximum power: 130 W (not including monitor power); 90 W continuous
Physical	Height: 5.5 in. (14 cm) Width: 11.9 in. (31.2 cm) Depth: 14.4 in. (36.5 cm) Weight: 13 lb., 10 oz. (6.2 kg)
Environmental	Operating temperature: 50–104° F (10–40° C) Storage temperature: -40 to 116.6° F (-40 to 47° C) Relative humidity: 20-80% non-condensing Altitude: 0–10,000 ft. (0–3048 m)

Symptom/Cure Chart

System Problems	Solutions
Four-tone startup error chord sounds (hardware failure)	1. Disconnect SCSI hard drive power and data cables and restart computer. 2. Disconnect floppy drive cable and restart computer. 3. Replace logic board.
Eight-tone startup error chord sounds (DRAM SIMM failure)	1. Replace DRAM SIMMs. 2. Replace logic board. 3. Perform DRAM SIMM verification with new logic board.
Doesn't power on—screen is black, fan is not running, and LED is not lit	1. Check cables. 2. Plug monitor directly into wall socket and verify that monitor has power. 3. Replace power cord. 4. Replace power supply. 5. Replace logic board. Move customer's SIMMs to new logic board.
Clicking, chirping, or thumping sound	1. Replace power supply. 2. Replace logic board. Move customer's SIMMs to new logic board.
System shuts down intermittently	1. Be sure to keep case air vents on sides and top. Thermal protection circuitry may shut computer down. After 30 to 40 minutes, computer should be OK. 2. Replace power cord. 3. Check battery. Replace battery if voltage is below 3.2. 4. Replace power supply. 5. Replace logic board. Move customer's SIMMs to new logic board.
System intermittently crashes or locks up	1. Make sure you are using correct version of system software. 2. Make sure you are using known-good software. 3. Identify and replace defective DRAM SIMMs. 4. Replace logic board. Move customer's SIMMs to new logic board. 5. Replace power supply.
Video Problems	**Solutions**
Screen is completely dark, fan is not running, and LED is not lit	1. Plug monitor directly into wall socket, and verify that monitor has power. 2. Check battery; replace if voltage is less than 3.2. 3. Replace power supply. 4. Replace logic board. Move customer's SIMMs to new logic board.
Partial or whole screen is bright and audio is present, but no video information is visible	1. Replace video cable. 2. If a video card is installed, move card to a different slot. 3. Replace video interface card, if installed. 4. Replace VRAM SIMMs. 5. Replace monitor. If replacing monitor corrects the problem, refer to *Service Source* for troubleshooting information. 6. Replace logic board. Move customer's SIMMs to new logic board.

Screen is black, audio and drive operate, fan is running, and LED is lit	1. Adjust brightness on monitor. 2. Replace video cable. 3. If video interface card is installed, move card to different slot. 4. Replace video interface card, if installed. 5. Replace VRAM SIMMs. 6. Replace defective DRAM SIMMs. 7. Replace monitor. If replacing monitor corrects the problem, refer to *Service Source* for troubleshooting information. 8. Replace logic board. Move customer's SIMMs to new logic board. 9. Replace power supply.
Screen is black, audio and drive don't operate, but fan is running and LED is lit	1. Replace video cable. 2. If video interface card is installed, move card to different slot. 3. Replace video interface card, if installed. 4. Replace VRAM SIMMs. 5. Replace defective DRAM SIMMs. 6. Replace logic board. Move customer's SIMMs to new logic board. 7. Replace power supply. 8. Replace monitor. If replacing monitor corrects the problem, refer to *Service Source* for troubleshooting information.

Floppy Drive Problems	**Solutions**
Internal floppy drive runs continuously	1. Replace bad disk with known-good system disk. 2. Replace floppy drive cable. 3. Replace floppy drive. 4. Replace logic board. Move customer's SIMMs to new logic board.
Audio and video are present, but internal floppy drive doesn't operate	1. Replace bad disk with known-good system disk. 2. Verify that all external SCSI devices are disconnected. 3. Replace floppy drive cable. 4. Replace floppy drive. 5. Replace logic board. Move customer's SIMMs to new logic board. 6. Replace power supply.
Disk ejects; display shows icon with blinking "X"	1. Replace bad disk with known-good system disk. 2. Replace floppy drive cable. 3. Replace floppy drive. 4. Replace logic board. Move customer's SIMMs to new logic board.
Drive won't eject disk	1. Switch power off and hold mouse button down while switching power back on. 2. Replace internal floppy drive.
Drive attempts to eject disk but can't	1. Reinsert disk and try to eject disk again. 2. Reseat drive bezel so slot in bezel aligns correctly with drive.
MS-DOS drive can't recognize disk formatted on 1.4 MB SuperDrive	– To ensure read/write compatibility with 1.4 MB SuperDrive, format all disks with MS-DOS drive first.

Hard Drive Problems	Solutions
Internal hard drive doesn't operate; drive doesn't spin	1. Replace internal hard drive cable. 2. Replace SCSI power cable. 3. Replace hard drive. 4. Replace logic board. Move customer's SIMMs to new logic board.
Drive doesn't appear on desktop	1. Make sure each SCSI device has a unique address. 2. Drive may not be initialized. If drive has just been installed, initialize drive with *HD SC Setup* and install system software.
Computer works with internal or external SCSI devices, but not both	1. Make sure SCSI device switch setting on external device(s) is not set to 7 (the computer address) or the same number as an internal SCSI device. 2. Replace external SCSI terminator. 3. Verify SCSI termination on internal SCSI drive. 4. Refer to *Service Source* to troubleshoot external device.

Peripheral Problems	Solutions
Cursor moves, but clicking mouse button has no effect	1. Replace mouse. 2. Replace logic board. Move customer's SIMMs to new logic board.
Cursor doesn't move	1. Check mouse connection. 2. Clean mouse. 3. If mouse was connected to keyboard, connect mouse to rear ADB port. If mouse works, replace keyboard. If mouse does not work in any ADB port, replace mouse. 4. Replace logic board. Move customer's SIMMs to new logic board.
No response to any key on keyboard	1. Check keyboard connection to ADB port. 2. Replace keyboard cable. 3. Replace keyboard. 4. Replace logic board. Move customer's SIMMs to new logic board.
Cannot double-click to open application, disk, or server	1. Remove duplicate system files from hard drive. 2. Clear parameter RAM. Hold down <Command> <Option> <R> <P> keys while booting system. Release keys when computer generates startup chord for second time. Reset mouse controls. 3. If mouse was connected to keyboard, connect mouse to rear ADB port. If mouse works, replace keyboard. If mouse does not work in any ADB port, replace mouse. 4. Replace logic board. Move customer's SIMMs to new logic board.
Known-good serial printer doesn't print	1. Make sure system software is version 7.0.1 or later. 2. Make sure Chooser and control panel settings are correct. 3. Replace printer interface cable. 4. Replace logic board. Move customer's SIMMs to new logic board.

Known-good LaserWriter on an AppleTalk network doesn't print	1. Make sure system software is version 7.0.1 or later. 2. Make sure Chooser and control panel settings are correct. 3. Refer to Networks manual in *Service Source*.

Miscellaneous Problems	**Solutions**
No sound from speaker	1. Verify that volume setting in control panel is one or above. 2. Replace speaker. 3. Replace logic board. Move customer's SIMMs to new logic board.

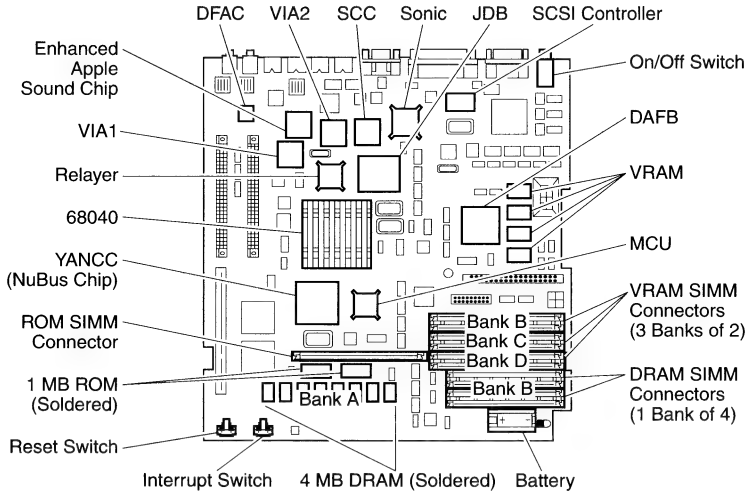


Figure 2 Macintosh Quadra 700 Logic Board

DRAM Upgrade

The Macintosh Quadra 700 has 4 MB of DRAM soldered on the logic board (bank A) and accepts four same-size DRAM SIMMs (80 ns or faster) in bank B. Configurations greater than 8 MB require third-party DRAM SIMMs.

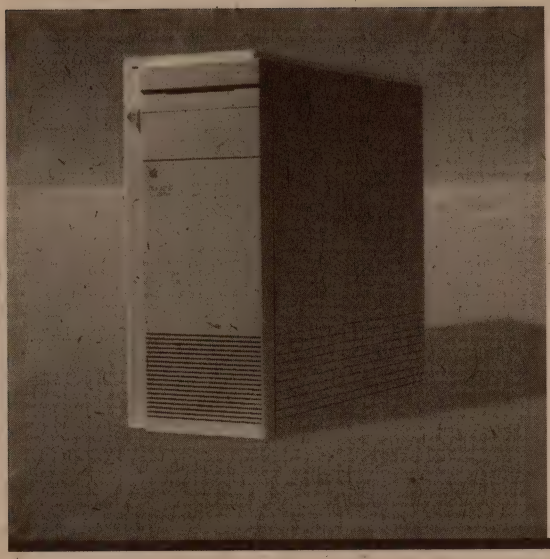
Total DRAM	Bank A (Soldered)	Bank B (SIMMs)
4 MB	4 MB	Empty
8 MB	4 MB	Four 1 MB SIMMs
20 MB	4 MB	Four 4 MB SIMMs

VRAM Upgrade

The Macintosh Quadra 700 has 512K of VRAM soldered on the logic board (bank A). VRAM is expandable to 1 MB or 2 MB by way of VRAM SIMM sockets (banks B, C, and D), each of which holds two 256K VRAM SIMMs.

Total VRAM	Bank A (Soldered)	Bank B (SIMMs)	Bank C (SIMMs)	Bank D (SIMMs)
512K	512K	Empty	Empty	Empty
1 MB	512K	Two 256K SIMMs	Empty	Empty
2 MB	512K	Two 256K SIMMs	Two 256K SIMMs	Two 256K SIMMs

Macintosh Quadra 900/950



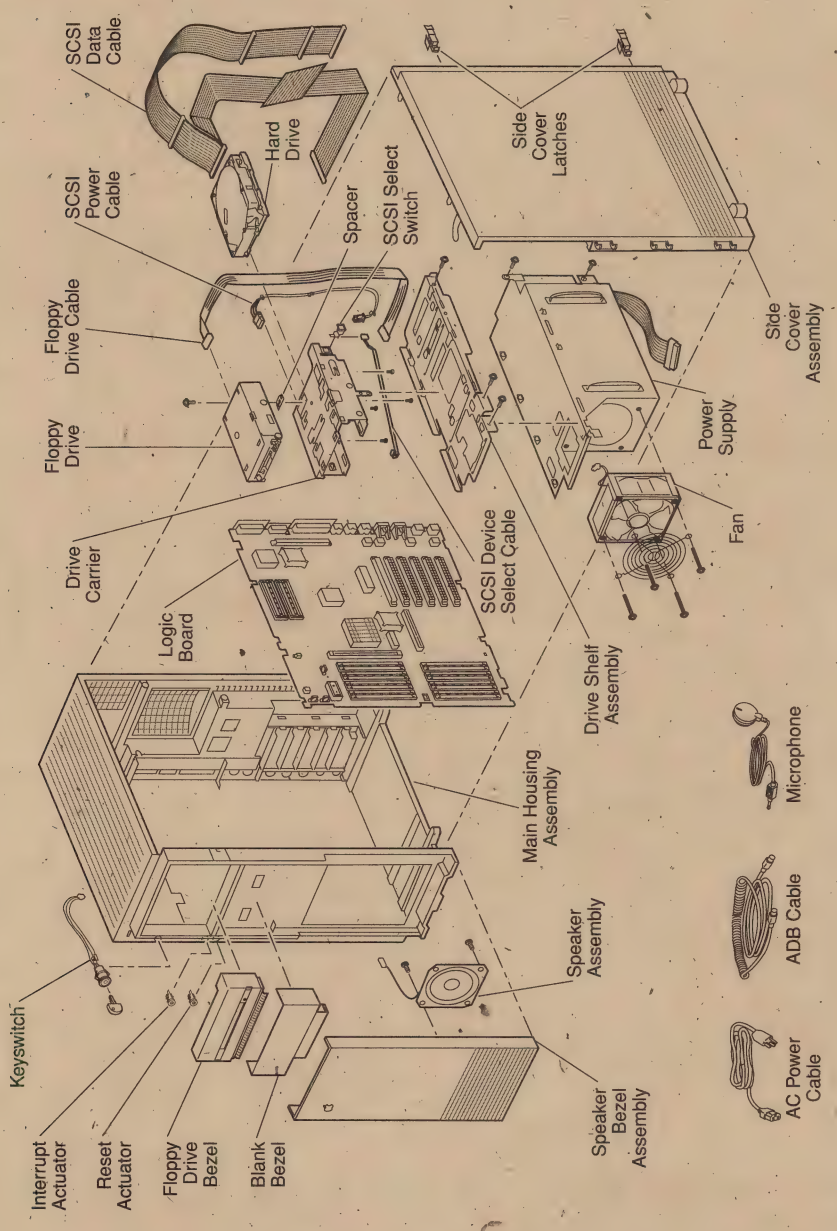


Figure 1 Macintosh Quadra 900/950 Exploded View

Apple logo 825-1256
Bezel assembly (blank) 076-0431
Cable, ADB, 2 meter 590-0152
Cable, AC power, 110 V 590-0760
Fan, power supply 720-0518
  Exhaust vent cover (included with main housing) 076-0432
Floppy drive, 1.4 MB Apple SuperDrive 661-0474
  Bezel assembly (floppy drive) 076-0437
  Cable, internal 590-0515
  Drive carrier (also used as shipping fixture) 805-5050
  Packing disk 003-0003
  Service packaging (floppy drive) 602-0210
  Spacer, (included in screw kit) 810-5113
HDA, 160 MB, 3.5" SCSI (without carrier) 661-1641
HDA, 400 MB, 3.5" SCSI (without carrier) 661-1636
  Cable, SCSI (with terminator) 590-0528
  Cable, SCSI power 590-0517
  Cable, SCSI device select (use with 661-1641) 590-0518
  Cable, SCSI device select (use with 661-1636) 590-0790
  Drive shelf assembly (with Velcro cable straps) 630-6097
  Hard drive carrier, internal 3.5" or 5.25" 805-5106
  Screw, 6 - 32 x .25 (hard drive carrier to hard drive) 444-6104
  Screw, 3.5 x .6 x .8 mm (drive shelf assy to power supply) 462-4100
  Service packaging, HDA, 3.5", half-height and 1-inch-height 602-0282
  Switch, SCSI device select 705-0045
Interrupt actuator 815-6250
Keyswitch (with two keys) 705-0175
Light pipe, power LED (included with main housing) 815-6251
Logic board (without DRAM/VRAM SIMMs) 661-0665
Logic board, 2 MB (Macintosh Quadra 950) 661-0665
  Battery holder cover 520-0344
  DRAM SIMM, 1 MB, 80 ns 661-0520
  DRAM SIMM, 1 MB, 80 ns 661-0719
  Jumper connector (pkg of 10) 517-0546
  Lithium battery (without leads) 742-0011
  VRAM SIMM, 256K 100 ns 661-0609
  VRAM SIMM, 256K 80 ns 661-0722
Main housing assembly 076-0434
Microphone assembly (Macintosh Quadra 900) 699-5073
Miscellaneous screw kit 076-0435
Power supply (includes fan) 661-0664
  Screw, 3.5 x .6 x .8 mm (power supply to case) 462-4100
Reset actuator 815-6249
Side cover latch 815-6262
Side cover assembly 076-0436
Speaker assembly 630-6011
  Speaker bezel 076-0433

Specifications

Processor	Motorola 68040 microprocessor; 25 MHz (Macintosh Quadra 900), 33 MHz (Macintosh Quadra 950); built-in paged memory management unit (PMMU), floating-point unit (FPU), and 8K memory cache Addressing: 32-bit registers; 32-bit address; 32-bit data bus
Memory	DRAM (Macintosh Quadra 900): 4 MB, expandable to 64 MB; 80 ns or faster SIMMs DRAM (Macintosh Quadra 950): 8 MB, expandable to 64 MB; 80 ns or faster SIMMs ROM: 1 MB, using two 150 ns, 256K by 16-bit chips PRAM: 256 bytes VRAM: 1 MB, expandable to 2 MB; 100 ns or faster VRAM SIMMS Clock/calendar: ASIC clock chip with PRAM and DFAC support and seven-year lithium battery
Disk Storage	Floppy drive: 1.4 MB floppy drive Hard drive (Macintosh Quadra 900): Optional, 160 or 400 MB hard drive Hard drive (Macintosh Quadra 950): Optional, 230 or 400 MB hard drive
I/O Interfaces	ADB: One ADB port; low-speed, synchronous serial interface Serial: Two RS-422/RS-232 ports; 230.4 Kbaud max.; mini DIN-8 connectors; 0.92 mbit/sec. if external clock source is provided (modem interface only); asynchronous, synchronous (modem only), and AppleTalk (printer only) protocols supported SCSI: One SCSI port; DB-25 connector; supports max. of eight devices (including computer, which is always device 7) NuBus: Five slots support standard oversize cards, burst-mode transfers, a processor write buffer, and NuBus '90; 96-pin Euro-DIN connectors Video: Supports Apple monitors (8-bit), VGA monitors, and NTSC and PAL video standards Ethernet: Built-in Ethernet port; AAUI-15 connector Expansion: One 68040 processor-direct slot (PDS); 140-pin connector Sound: 8-bit stereo output; 8-bit monaural input; supports electret-type microphone
I/O Devices	Keyboard: Supports all Apple ADB keyboards; mini DIN-4 connector Mouse: ADB mouse; mini DIN-4 connector

Sound and Video	Sound generator: Four-voice, wavetable synthesis and stereo sampling generator Video: Built-in, 8-bit video circuitry (upgradeable to 24-bit); supports Apple 8-bit monitors and many non-Apple monitor types (NTSC, PAL, VGA) Microphone: Electret, omnidirectional; output voltage is 4 mV, peak-to-peak, at normal value
Electrical	Line voltage: 100-240 VAC (RMS), self-configuring power supply Frequency: 50-60 Hz, single phase Maximum power: 303 W (not including monitor power)
Physical	Height: 18.6 in. (47.3 cm) Width: 8.9 in. (22.4 cm) Depth: 20.6 in. (523 cm) Weight: 36 lb., 12 oz. (16.7 kg) without hard drive
Environmental	Operating temperature: 50–104° F (10–40° C) Storage temperature: -40 to 116.6° F (-40 to 47° C) Relative humidity: 20-80% non-condensing Altitude: 0–10,000 ft. (0–3048 m)

Symptom/Cure Chart

System Problems	Solutions
Four-tone error chord plays at startup	1. If system boots from internal hard drive, disconnect SCSI cable from logic board and restart system. If startup sequence is normal, reinitialize hard drive. If error chord still sounds, replace hard drive. 2. If system boots from internal floppy drive, disconnect floppy drive cable and restart system. If startup sequence is normal, replace floppy drive. 3. If error chord still sounds at startup, replace logic board. Move customer's SIMMs to new logic board.
Eight-tone error chord plays at startup	– Install four known-good SIMMs in bank A and switch on system. If no error chord sounds, test customer's SIMMs. (Switch system off, replace one known-good SIMM with customer SIMM. Switch system on. If no error chord sounds, customer SIMM is good. Repeat test for each SIMM.)
System doesn't power on—screen black, fan not running, and LED not lit	1. Check power cables. 2. Plug monitor directly into wall socket and verify that monitor has power. 3. Replace power cord. 4. Replace power supply. 5. Replace logic board. Move customer's SIMMs to new logic board.
Clicking, chirping, or thumping sound	1. Replace power supply. 2. Replace logic board. Move customer's SIMMs to new logic board. 3. Replace floppy drive cable. 4. Replace floppy drive.
System shuts down intermittently	1. Make sure air vents at rear of system and on side cover are clear. Thermal protection circuitry may shut system down. System should start after 30 to 40 minutes. 2. Replace power cord. 3. Check voltage of lithium battery on logic board. If battery voltage is below 3.2 volts, replace battery. 4. Replace power supply. 5. Replace logic board. Move customer's SIMMs to new logic board.
System crashes or hangs intermittently	1. Make sure system software is 7.0.1 or later. 2. Verify that software (applications, INITs, CDEVs, RDEVs, etc.) is compatible with System 7. 3. Identify and replace defective DRAM SIMMs. 4. Replace logic board. Move customer's SIMMs to new logic board. 5. Replace power supply.
System doesn't power on when monitor not attached	1. Attach monitor to system. (Unless system is configured as a server, it will not power on without monitor attached.) 2. If system is a server, install Virtual Monitor Switch Control panel to power-on system.

Video Problems	Solutions
Partial or whole screen bright and audio present, but no video information visible	1. Replace monitor. If replacing monitor corrects video problem, refer to appropriate *Service Source* manual for monitor troubleshooting information. 2. Replace video cable. 3. Move video interface card (if installed) to a different slot. 4. Replace video interface card (if installed). 5. Replace logic board. Move customer's SIMMs to new logic board.
Screen is black, audio and drive operate, fan runs, and LED is lit	1. Adjust brightness on monitor. 2. Replace monitor. If replacing monitor corrects video problem, refer to appropriate *Service Source* manual for monitor troubleshooting information. 3. Replace video cable. 4. If video interface card is being used with monitor, move card to a different slot. 5. If video interface card is being used with monitor, replace card. 6. Identify and replace defective DRAM SIMMs. 7. Replace logic board. Move customer's SIMMs to new logic board. 8. Replace power supply.
Screen is black, audio and drive don't operate, fan runs, and LED is lit	1. Replace video cable. 2. Move video interface card (if installed) to a different slot. 3. Replace video interface card (if installed). 4. Identify and replace defective DRAM SIMMs. 5. Replace logic board. Move customer's SIMMs to new logic board. 6. Replace power supply.

Floppy Drive Problems	Solutions
Drive doesn't operate	1. Verify that keyswitch is not on secure. 2. Replace floppy disk. 3. Replace floppy drive cable. 4. Replace floppy drive. 5. Replace logic board. Move customer's SIMMs to new logic board. 6. Replace power supply.
Drive runs continuously	1. Replace floppy disk. 2. Replace floppy drive cable. 3. Replace floppy drive. 4. Replace logic board. Move customer's SIMMs to new logic board.
During system startup, disk ejects; display shows icon with blinking "X"	1. Replace disk with known-good system disk. 2. Replace floppy drive cable. 3. Replace floppy drive. 4. Replace logic board. Move customer's SIMMs to new logic board.

Drive won't eject disk	1. Verify that keyswitch is not on *secure.* 2. Switch power off and hold mouse button down while switching power back on. 3. Replace floppy drive. 4. Replace floppy drive cable. 5. Replace logic board. Move customer's SIMMs to new logic board.
Drive attempts to eject disk, but disk doesn't eject	1. Reseat floppy drive bezel and/or floppy drive so that slot in bezel aligns correctly with floppy drive. 2. Eject disk manually with paper clip. 3. Replace floppy drive.
MS-DOS drive doesn't recognize disk formatted on SuperDrive	– Format all disks with the MS-DOS drive first.

Hard Drive Problems	**Solutions**
Single internal SCSI drive doesn't operate; drive doesn't spin	1. Replace SCSI cable. 2. Replace SCSI power cable. 3. Replace SCSI drive.
Drive doesn't appear on desktop	1. Make sure each SCSI device has unique address. 2. Use *HD SC Setup* to initialize drive.
No internal SCSI drives operate	1. Make sure each SCSI device has unique address. 2. Verify SCSI device termination. 3. Replace SCSI cable. 4. Replace power supply. 5. Replace logic board. Move customer's SIMMs to new logic board.
System works with internal or external SCSI devices, but not with both	1. Make sure each SCSI device has unique address. 2. Replace external SCSI terminator. 3. Make sure internal SCSI drives are not terminated. 4. Troubleshoot external device using appropriate *Service Source* manual.

Peripheral Problems	**Solutions**
Cursor doesn't move	1. Make sure keyswitch is not on *secure.* 2. Check mouse connection. 3. Inspect inside of mouse for buildup of dirt or other contaminants. Clean mouse. 4. If mouse was connected to keyboard, connect mouse to rear ADB port. If mouse now works, replace keyboard. If mouse doesn't work in any ADB port, replace mouse. 5. Replace logic board. Move customer's SIMMs to new logic board.
Cursor moves, but clicking mouse button has no effect	1. Replace mouse. 2. Replace logic board. Move customer's SIMMs to new logic board.

No response to any key on keyboard	1. Make sure keyswitch is not on *secure.* 2. Verify keyboard connection to ADB port. 3. Replace keyboard cable. 4. Replace keyboard. 5. Replace logic board. Move customer's SIMMs to new logic board.
Cannot double-click to open a disk, application, or server	1. Remove extra system files on hard drive. 2. Clear parameter RAM. Hold down <Option> <Command> <P> and <R> keys during startup but before "Welcome to Macintosh" message appears. 3. If mouse was connected to a keyboard, connect mouse to a rear ADB port. If mouse works, replace keyboard. If mouse does not work in any ADB port, replace mouse. 4. Replace logic board. Move customer's SIMMs to new logic board.
Known-good serial printer doesn't print	1. Make sure system software is version 7.01 or later. 2. Make sure Chooser settings are correct. 3. Replace printer interface cable. 4. Replace logic board. Move customer's SIMMs to new logic board.
Known-good printer on AppleTalk network doesn't print	1. Make sure system software is version 7.01 or later. 2. Make sure Chooser settings are correct. 3. Refer to Networks tab in *Service Source.*

Miscellaneous Problems	**Solutions**
No sound from speaker	1. Make sure speaker volume setting in the Sound control panel is one or above. 2. Replace speaker. 3. Replace logic board. Move customer's SIMMs to new logic board.

The Macintosh Quadra 900 ships with four 1 MB DRAM SIMMS on the logic board; the Macintosh Quadra 950 ships with eight 1 MB DRAM SIMMs. You can increase the amount of memory (up to 64 MB) by installing additional SIMMs in an empty SIMM bank or by replacing the original 1 MB SIMMs with larger 4 MB SIMMs.

The Macintosh Quadra 900 and 950 have four banks of DRAM SIMM sockets (banks A, B, C, and D, shown in Figure 2). Each bank contains four slots. When installing DRAM SIMMs in the Macintosh Quadra 900 or 950, the following rules apply:

- Use DRAM SIMMs that are 80 ns or faster (SIMMs with slower ratings will cause serious timing problems and system crashes).
- Fill each bank with DRAM SIMMs or leave each bank empty.
- A filled bank must have four DRAM SIMMs of the same size (four 1 MB SIMMs or four 4 MB SIMMs).

To install a SIMM, hold it by its edges with the contacts pointing down. Insert the SIMM at an angle (bottom forward) into the SIMM slot. Push back on the top corners of the SIMM. You will hear a click when the SIMM snaps into place.

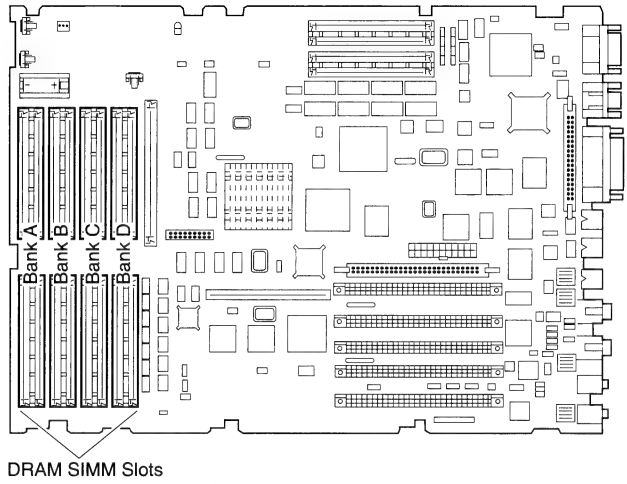


Figure 2 DRAM SIMM Slots on the Logic Board

The Macintosh Quadra 900 and 950 ship with 1 MB of VRAM soldered on the logic board. You can increase the amount of VRAM to 2 MB by installing additional VRAM SIMMs, as the following procedure explains.

The Macintosh Quadra 900 and 950 have two VRAM SIMM sockets (J3 and J4, shown in Figure 3). Each socket can hold up to two 256K VRAM SIMMs. When installing VRAM SIMMs, the following rules apply:

- Use VRAM SIMMs that are 100 ns or faster (SIMMs with slower ratings will cause video timing problems).
- Fill both VRAM SIMM sockets or leave both sockets empty.
- Filled SIMM sockets must contain four 256K VRAM SIMMs.

To install a SIMM, hold it by its edges with the contacts pointing down. Insert the SIMM at an angle (bottom forward) into the SIMM slot. Push back on the top corners of the SIMM. You will hear a click when the SIMM snaps into place.

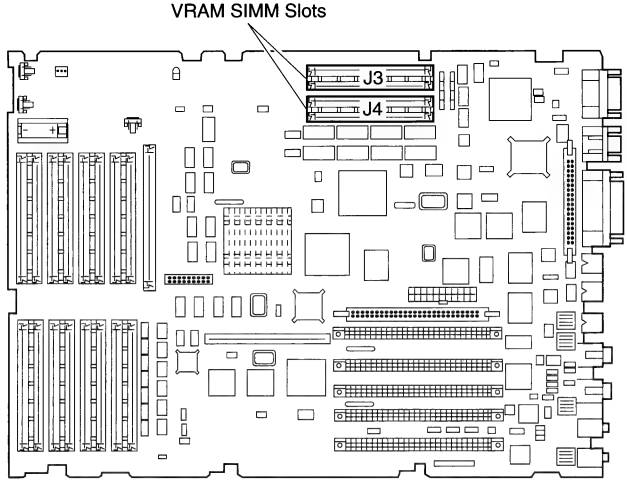


Figure 3 VRAM SIMM Slots on the Logic Board

The Macintosh Quadra 900 and 950 support a variety of Apple and third-party internal SCSI devices including 3.5" and 5.25" hard drives, CD-ROM drives, removable cartridge drives, digital audio tape (DAT) drives, and drive arrays. These computers support a maximum of four devices, including the built-in Apple SuperDrive.

When installing a SCSI storage device, remember the following:

- Remove termination resistors before installing a device. The Macintosh Quadra 900 and 950 have built-in termination. Failure to remove the termination resistors from installed devices can result in damage to the logic board.
- The power supply provides a maximum of 303 watts.
- Unplug the computer before beginning any take-apart or upgrade procedure. The power supply provides continuous power to the system to support back-up power to NuBus cards. You can damage the logic board and NuBus cards by not removing power prior to beginning.

To install an internal SCSI device in the Macintosh Quadra 900 and 950:

1. Remove the side cover.
2. Disconnect the floppy drive and hard drive data cables from the logic board and the hard drive power cable from the power supply (Figure 4).

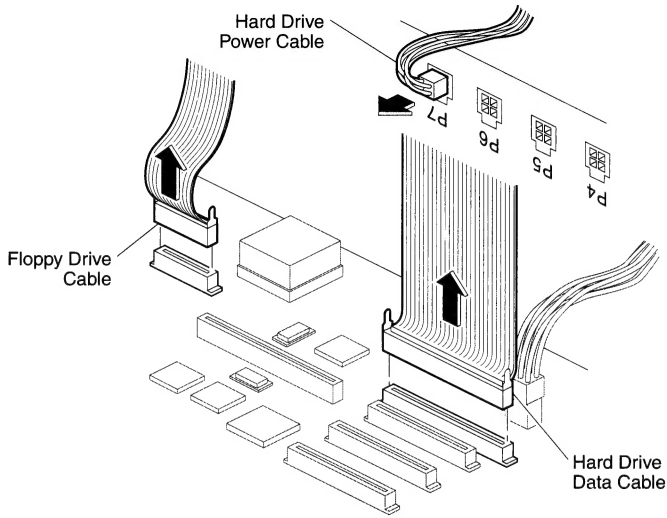


Figure 4 Disconnecting the Drive Cables

3. Remove the two drive shelf screws, slide the drive shelf toward the rear of the computer, and carefully lift the shelf out of the case.
4. Install the SCSI device in the drive carrier as shown in Figure 5. Be sure to connect the SCSI select switch. Also, verify that the device is not terminated.

Note

Fixed-media devices (Winchester hard drives or drive arrays) can be installed in any open position.

Removable-media devices (DAT, CD-ROM, or removable hard drives) must be installed below the floppy drive. (You must remove the floppy drive first. You will also need to replace the blank bezel with the bezel supplied with the device. See Service Source for step-by-step instructions.)

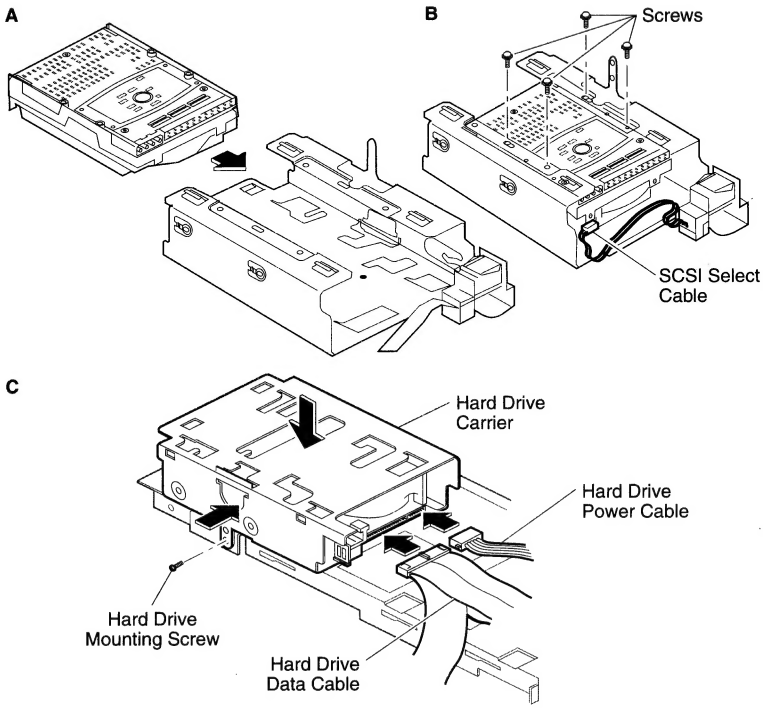


Figure 5 Installing a SCSI Device

5. Replace the drive shelf and reconnect all cables.
6. Replace the side cover.

Logic Board Diagram

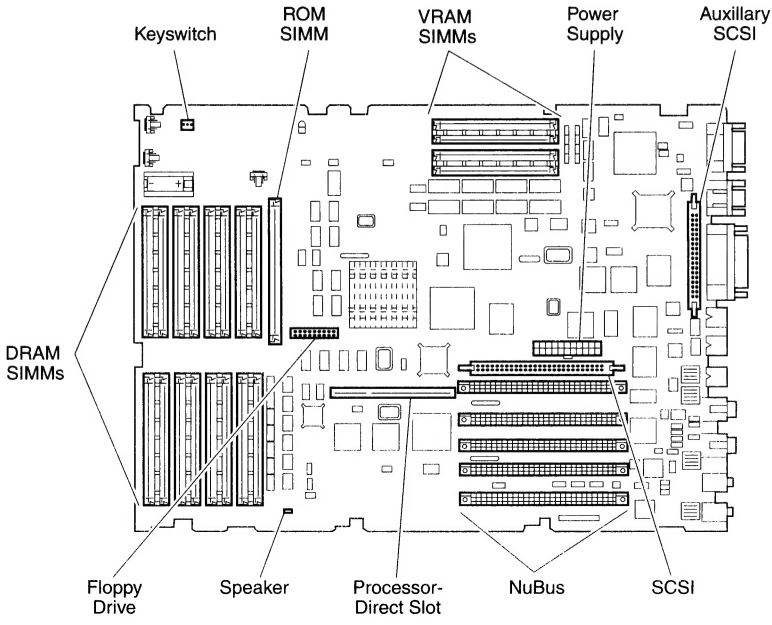


Figure 6 Macintosh Quadra 900/950 Logic Board Connectors

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